Clinician's Commentary

Gait deficits greatly contribute to functional disability after stroke; of all stroke-related impairments, improvement of walking function is the goal most often stated by patients.¹ Therefore, gait is a primary focus of physiotherapy intervention post-stroke. Most of the research on post-stroke gait focuses on velocity or endurance. By contrast, temporal and spatial symmetry (although not new to clinical practice) receive relatively less attention. To date, most studies have only reported symmetry values. Very few studies have included gait symmetry as their main focus, and fewer still have attempted to understand the underlying mechanisms of asymmetry.²

Post-stroke gait asymmetry is the main focus of the study by Beauchamp et al. in this issue of *Physiotherapy Canada*.³ More specifically, the investigators examined the immediate effects of cane use on the symmetry of patients with stroke in the subacute stage. According to their results, a standard cane, but not a quad cane, improves symmetry in individuals with an asymmetrical gait pattern.³ By contrast, there was no observed effect of cane use in those patients with a symmetrical gait pattern.³

The study by Beauchamp et al. illustrates two important issues relevant to clinical practice and research in stroke rehabilitation. First, it demonstrates the value of categorizing patients with stroke in finer detail than is possible using velocity or a measure of motor impairment, such as the Chedoke-McMaster Stroke Assessment (CMSA), alone. Typical gait deficits associated with stroke include decreased velocity, increased step variability, increased or decreased joint displacement, and altered EMG timing and amplitude.⁴ Although any given individual with stroke will likely display some unique combination of the common deviations described above, he or she is unlikely to display all the deviations. More simply, no two persons with stroke are alike. This presents a challenge for both clinicians and researchers. For clinicians, no one therapeutic approach will be appropriate for all patients. Developing a method for classification of individuals with stroke that uses a composite of key measurements (e.g., velocity, gait variability, and gait symmetry as well as motor impairment) will assist the clinician in designing physiotherapy programs tailored to the individual patient. For researchers, results can be attenuated by an averaging effect of responders and non-responders within a study sample. *A priori* classification of study participants can circumvent this challenge, as Beauchamp et al.'s study clearly demonstrates. Using gait symmetry as the basis for categorization, the authors were able to demonstrate the effects of cane use in a subset of the subjects they

recruited, something previous studies were unable to show.³

The second important point highlighted by Beauchamp et al. is the issue of gait asymmetry itself. Considerable attention has been focused on the measurement and improvement of gait velocity post-stroke. As a clinical measure, velocity reflects overall performance; however, it is limited in its value to document post-stroke recovery. In addition, velocity provides no information on the underlying impairments contributing to gait dysfunction.^{5,6} Gait symmetry is a complementary measure that may reflect the quality of gait. Brandstater et al.⁷ suggested that symmetry may characterize post-stroke gait better than unilateral values. In addition to its value as a clinical gait measure, asymmetry is an important issue to address therapeutically because of its possible negative consequences, which include increased challenge to balance control, increased energy expenditure during walking, and negative impact on the musculoskeletal health of the non-paretic limb.⁸ In addition, individuals post-stroke may decrease their overall activity levels, over time, in response to any one or combination of these factors.⁸ In light of these possible effects, gait asymmetry should be addressed by post-stroke gait rehabilitation programs.

A commonly identified barrier to taking objective, quantitative measures of gait (such as gait symmetry) in the clinical setting is cost. The Beauchamp et al. study measured spatiotemporal gait parameters using the GAITRite mat, which costs approximately \$17,000. At first, this seems expensive; however, the average treadmill and body-weight support (BWS) system costs \$27,000, and this equipment is more readily adopted in the clinical setting. It is more informative to discuss cost-benefit trade-offs than to rely on cost alone. Clinicians perceive a benefit to patients and their practice from the BWS treadmill, and thus the cost of purchasing the equipment is outweighed by its positive effects on patient gait. Once we have established the value of objective, quantitative gait measurements, including symmetry, to clinical practice, purchasing the equipment necessary to provide these measurements will also seem like a sound decision. Furthermore, a clinical community more focused on objective, quantitative measures of gait would further stimulate the development and commercialization of new, simple, and cost-effective measurement solutions.⁸ In order to establish the value of measuring and treating post-stroke gait asymmetry, more research is needed.

The goal of most post-stroke gait research is to examine or improve velocity, endurance, or both.

Measurement or improvement of gait symmetry is rarely the primary focus, with a few exceptions.^{9–11} The study by Beauchamp et al. is the latest of a small number of studies to focus on gait symmetry, potentially a more important gait outcome, given its associated negative consequences. According to their results, use of a cane may be one approach to ameliorate asymmetry in the subacute stroke population. Their findings complement research presently under way examining the feasibility of visual biofeedback during treadmill walking as another intervention to improve gait symmetry.¹²

There is a need for more research in this area. As outlined by Beauchamp et al., the clinically meaningful change in symmetry needs to be established.³ Other important research areas are the following:

1. Determination of a threshold for symmetry: What degree of asymmetry is associated with the possible negative consequences outlined above?
2. Determination of the underlying causes of asymmetry: although motor impairment is associated with gait symmetry, as Beauchamp et al. describe, it does not explain all of the variance observed in the stroke population. Furthermore, our work has revealed that individuals with the same level of motor impairment, as measured by the CMSA, can have different degrees of asymmetry.⁸ Understanding the underlying causes of asymmetry will assist in the development of rehabilitation programs that promote symmetrical gait.
3. Examination of the effectiveness of rehabilitation protocols for gait symmetry.

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DOI:10.3138/physio.61.3.161