

# Walking impairment in patients with multiple sclerosis

## *The impact of complex motor and non-motor symptoms across the disability spectrum*



CPD 

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### Background

Multiple sclerosis (MS) is a neurodegenerative pathology that affects young people in the prime of their lives, often having an impact on motor tasks such as walking, which subsequently affects participation in daily activities. The symptoms caused by MS are highly variable, and rehabilitation strategies, which often focus on movements and exercises to improve symptoms or function, are variable in success.

### Objective

The aim of this article is to summarise how motor and non-motor symptoms have an impact on walking ability in people with MS, and how this impact may vary across disability levels.

### Discussion

A variety of motor and non-motor symptoms are common in people with MS early after diagnosis, but they vary in their impact on walking, and this differs by disability level. A comprehensive assessment of all symptoms is required to understand contributors to walking disability and thus direct targeted non-pharmacological management options.

**MULTIPLE SCLEROSIS** (MS) is a progressive neurological autoimmune disease resulting in myelin destruction and associated axonal damage.<sup>1</sup> MS is the leading cause of neurological disability and symptoms in young adults, with more than 25,000 people in Australia (prevalence 103.7/100,000) reported to have MS.<sup>2</sup> The number of people living and being diagnosed with MS in Australia has increased by 20% in the past seven years, with the most common age of diagnosis between 20 and 40 years, and nearly three-quarters of all people with MS being female.<sup>2</sup> Consequently, the average yearly cost to society for each person with MS is estimated to be \$68,000, as the pathology affects a person in the prime of their economic and family life.<sup>2</sup> People with MS report that walking is one of the most valuable functions to maintain quality of life.<sup>3</sup> Therefore, establishing the bodily functions associated with MS that contribute to walking impairment and are positively influenced by non-pharmacological management is relevant to the medical community. The aim of this article is to outline motor and some less commonly considered non-motor symptoms reported by people with MS and review their impact on walking impairment across the disability spectrum.

The degree of walking disability is important to capture in people with MS. Currently, disability is captured using the Expanded Disability Status Scale (EDSS) within specialised healthcare settings. However, the EDSS takes 20–30 minutes to complete, requires training to optimise reliability and has low responsiveness to functional change in people with MS.<sup>4</sup> A simpler, more clinically useful tool used to categorise disability in the non-specialised health setting is the Disease Step Rating Scale (DSRS),<sup>5</sup> a two-minute observation-based clinician-rated scale validated for use in people with MS (Table 1). The DSRS has validity in capturing statistically significant and clinically meaningful changes to walking impairment between categories.<sup>6</sup> Although the EDSS is widely used in research and specialist healthcare contexts, the DSRS is a valid, simple and clinically reliable tool to assess and monitor changes in disability in a primary healthcare setting.

People with MS experience motor and non-motor symptoms that are diverse and complex, and they often have a hidden negative impact on walking and participation.<sup>7</sup> Symptoms can include muscle weakness; spasticity; and sensory, visual and vestibular dysfunction. The impact varies depending on the level of walking impairment.<sup>8</sup>

## Motor dysfunction

Muscle weakness and muscle fatiguability are associated with a reduction in walking function in people with MS.<sup>9</sup> Approximately 18% of people with MS with no observable walking disability have lower limb muscle weakness,<sup>10</sup> with the percentage rising to 100% of those needing to use bilateral walking aids.<sup>11</sup> Interestingly, muscle weakness<sup>12</sup> and muscle fatiguability<sup>13</sup> have strong correlations with walking impairments in people with MS who have higher levels of disability, but not in those with lower disability levels. This suggests that symptoms other than weakness may have a greater impact on walking ability in people who are less disabled. Spasticity is reported in up to 80% of people with MS and may be one of those symptoms.<sup>14</sup> Spasticity adversely affects walking across all disability levels,<sup>15</sup> increasing in impact as spasticity scores and the number of muscles affected increase.<sup>16</sup> Currently, pharmacological management is the primary approach, using the following three hierarchical treatment strategies: 1) oral pharmacological treatment for more global symptoms (baclofen, gabapentin, tizanidine), 2) local injectables (botulinum) and 3) intrathecal administration (baclofen, phenol) in selected patients.<sup>17</sup> Pharmacological benefits on spasticity alone have limited evidence for the improvement of walking

ability;<sup>18</sup> however, when combined with appropriate physiotherapy exercises, walking impairments are reduced.<sup>19</sup>

The impact of non-motor factors – such as somatosensory, visual and vestibular dysfunction – may also explain why some exercise-based rehabilitation programs aimed at improving muscle strength and muscle fatigue in people with MS show mixed benefits in relation to walking impairment.<sup>20–22</sup>

## Somatosensory dysfunction

Light touch dysfunction is identified in up to 85% of people with MS and is commonly reported within the first year of diagnosis.<sup>7</sup> Several studies have identified a negative impact of impaired light touch on walking speed, indicating this clinical relationship may vary by disability level.<sup>8</sup> Proprioceptive dysfunction (joint position sense) and reduced vibration sense is reported in up to 65% of people with MS,<sup>23,24</sup> with poor joint position sense<sup>8,23</sup> and lower vibration sense<sup>25</sup> reported or captured more frequently in those with higher disability. However, proprioceptive<sup>26</sup> and vibration sense<sup>25</sup> dysfunction have a greater impact on walking impairment in those with MS who are less disabled. Positively, emergent research targeting sensory dysfunction by using textured insoles has shown improvements in somatosensory

dysfunction and walking impairment.<sup>27</sup>

Considering the evidence, combining more proprioceptive, vibration and strengthening strategies in exercises for people with MS who are less disabled may provide stronger evidence that supports improvement in walking impairments in this group.

## Vision dysfunction

Vision dysfunction encompasses difficulties experienced by people with MS from afferent visual pathways (reduced visual acuity, eg optic neuritis, and visual field defects, eg central scotoma), disorders of fixation (eg nystagmus and saccadic eye movements) and ocular motility dysfunction (reduced eye movement symmetry, eg intranuclear ophthalmoplegia).<sup>28</sup> These impairments result in blurred and/or double vision, reduced visual fields and difficulty with colour and contrast recognition.<sup>28</sup> Patient-reported outcome measures, such as the 25-Item National Eye Institute Visual Function Questionnaire (VFQ-25),<sup>29</sup> capture the depth and breadth of visual dysfunction and symptoms experienced by people with MS. Approximately 50% of people with MS will develop optic neuritis over the course of their lifetimes,<sup>30</sup> 14% will have internuclear ophthalmoplegia,<sup>31</sup> and up to 90% will experience abnormal smooth pursuit, saccades and gaze-evoked nystagmus.<sup>32</sup> Standard visual acuity testing can fail to capture visual dysfunction from optic neuritis, and low-contrast vision testing is required.<sup>33</sup> Reduced visual contrast sensitivity is correlated with a higher falls risk in people with MS<sup>34</sup> and slower walking speed and worse balance in those with less disability, especially in low light conditions.<sup>35</sup> Similarly, oculomotor abnormalities affect walking speed and balance in those with lower disability levels.<sup>36</sup> Assessments of visual contrast sensitivity and oculomotor function are quick and simple to undertake clinically, providing an opportunity to identify these deficits and support patients to access appropriate therapy. Additionally, pharmacological<sup>28</sup> and oculomotor exercise combined with balance exercise interventions can reduce the impact

**Table 1. The Disease Step Rating Scale – abbreviated version<sup>5</sup>**

Low disability		
0	Normal	Functionally normal with no limitations on activity or lifestyle
1	Mild disability	Mild symptoms and/or signs; no visible abnormality of gait
2	Moderate disability	Main feature is a visibly abnormal gait; no aide use
High disability		
3	Early cane	Use a cane/unilateral support for greater distances but can walk at least 25 feet without it. Includes use of splint or brace.
4	Late cane	Unable to walk 25 feet without a cane/unilateral support
5	Bilateral support	Requires bilateral support to walk 25 feet
6	Wheelchair	Essentially confined to wheelchair
U	Unclassifiable	Used for patients who do not fit above classification

of some oculomotor dysfunctions and improve walking ability,<sup>37</sup> while tinted lenses can improve walking impairment in low light.<sup>35</sup>

### Vestibular dysfunction

The vestibular system senses the position of self in relation to gravity and the direction and velocity of head movement. Dysfunction can present as a sense of dizziness, vertigo or imbalance and can lead to oscillopsia due to a decline in the gain of the vestibular ocular reflex (VOR).<sup>38</sup> Dizziness or vertigo may originate centrally (from the brainstem/cerebellum) or peripherally (vestibular apparatus and the eighth cranial nerve).<sup>39,40</sup>

Vertigo or dizziness are commonly reported by people with MS, with up to 80% of individuals experiencing vertigo or dizziness across the course of the disease.<sup>7,8</sup> Disease duration does not affect the prevalence of dizziness, and there is no clear difference in the impact of dizziness on walking impairment between people with high or low levels of disability.<sup>8</sup> Low VOR gains are rare in people with MS;<sup>41</sup> however, a VOR gain at the lower end of normal in those with higher disability levels can affect walking impairment and balance confidence.<sup>42,43</sup> Appropriately

targeted vestibular rehabilitation can have a positive impact on walking and balance in people with MS, measured by improvements in the Dizziness Handicap Inventory and the Timed Up and Go test (Table 2).<sup>44</sup>

### Conclusion

Motor and non-motor symptoms affect walking impairment in people with MS, and the impact of symptoms varies with disability level. Motor deficits are the most obvious symptom to explore when examining walking impairment in people with MS. However, it is also critical to understand the role of the non-motor somatosensory, visual and vestibular symptoms that can also affect walking. Targeted clinical assessments can identify motor and non-motor impairments and enable appropriate and timely referral for ongoing assessment and management. Routine use of a simple, validated clinical assessment tool to identify disability level (DSRS) can also assist holistic management over the course of the disease process. Numerous other symptoms not discussed here can affect walking impairment. These include, but are not limited to, fatigue, pain, autonomic dysfunction and cognition.

Fatigue in particular has an influence on deterioration of walking speed, with greater impact on people with higher disability.<sup>45</sup> Greater detail is beyond the scope of this article, and each symptom deserves specific discussion.

GPs are well placed to support people with MS by providing education about the impact of motor and non-motor symptoms on walking impairment and the benefit of seeking early and targeted support from skilled health professionals, including those with advanced training in management of people with neurological conditions.

### Key points

- Motor and non-motor symptoms and their impact on walking show considerable individual variation in people with MS across disability levels.
- While motor deficits such as muscle weakness or spasticity commonly affect walking, deterioration in sensory systems can also affect the ability to walk.
- Approximately 80% of people with MS experience deficits in light touch and vestibular function, which can affect walking ability.
- A comprehensive assessment of motor and non-motor symptoms

**Table 2. Summary of key symptom assessment tools associated with walking and multiple sclerosis impact outcomes categorised at two disability levels**

Assessment tools	Low disability level	High disability level
<b>Walking outcomes</b> <ul style="list-style-type: none"> <li>• Walking speed – Timed 10-metre walk test; timed 25 ft walk test</li> <li>• Walking balance – Timed Up and Go (comfortable/fast, +/- manual/cognitive)</li> <li>• Walking endurance – 2/6/12-minute walk test</li> </ul>	<b>Symptom assessment tools</b> <ul style="list-style-type: none"> <li>• Proprioception – contralateral limb copy test</li> <li>• Vibration test – 128 Hz tuning fork, timed</li> <li>• Low-contrast visual acuity – Sloan letter chart</li> <li>• Bedside oculomotor examination</li> <li>• Clinical Head Impulse Test</li> <li>• Dynamic Visual Acuity Test</li> </ul>	<b>Symptom assessment tools</b> <ul style="list-style-type: none"> <li>• Manual Muscle Test</li> <li>• Light touch – Semmes-Weinstein monofilaments</li> <li>• Vestibular Ocular Testing</li> <li>• Clinical Head Impulse Test</li> <li>• Dynamic Visual Acuity Test</li> </ul>
<b>Patient-reported walking outcomes</b> <ul style="list-style-type: none"> <li>• 12-item Multiple Sclerosis Walking Scale<sup>46</sup></li> <li>• Activities-specific Balance Confidence scale<sup>47</sup></li> <li>• 29-item Multiple Sclerosis Impact Scale<sup>48</sup></li> </ul>	<b>Patient-reported outcomes</b> <ul style="list-style-type: none"> <li>• Self-reported dizziness, Dizziness Handicap Inventory<sup>46</sup></li> <li>• 25-Item National Eye Institute Visual Function Questionnaire<sup>29</sup></li> </ul>	<b>Patient-reported outcomes</b> <ul style="list-style-type: none"> <li>• Self-reported dizziness, Dizziness Handicap Inventory<sup>49</sup></li> <li>• 25-Item National Eye Institute Visual Function Questionnaire<sup>29</sup></li> </ul>

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should be performed by skilled health professionals such as a neurologist, neurological physiotherapist or general practitioner to optimally target non-pharmacological interventions to improve walking performances in people with MS.

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