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CASE REPORT

Multidomain Functional Improvement Following a Device-free SONAPS Program in Late-onset Multiple Sclerosis: A Case Report of a 75-year-old Patient

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Abstract

Functional improvement in late-onset secondary progressive multiple sclerosis is uncommon, particularly in elderly patients with a long disease duration. We report the case of a 75-year-old man with symptom onset after the age of 50 and more than 20 years of progressive multiple sclerosis who experienced sustained, multidomain functional improvement following a short, non-invasive, non-pharmacological, device-free Somatic-neuropsychological adaptive programming system program delivered over approximately 60 days. The patient had not received disease-modifying therapy or physiotherapy for several years prior to the intervention. Global disability, assessed using the composite disability and functional status Scale, decreased from 29/50 to 3/50, accompanied by improvements across physical, functional, and psychological domains. Clinical improvements remained stable at 3-, 9-, and 12-month follow-up, with no adverse events reported. These findings should be interpreted as hypothesis-generating clinical observations rather than as evidence of treatment efficacy.

Keywords: Late-onset multiple sclerosis, secondary progressive multiple sclerosis, multidomain functional improvement, non-pharmacological intervention, case report

Introduction

Progressive multiple sclerosis (MS) is characterized by the gradual accumulation of neurological disability across motor, sensory, cognitive, and behavioral domains. In advanced stages of the disease, sustained functional improvement is considered biologically challenging, particularly in elderly patients with a long disease duration.

Late-onset MS, defined as symptom onset after the age of 50 years, represents a relatively uncommon phenotype and is often associated with more rapid disability progression and a greater comorbidity burden.

In this context, documenting multidomain clinical improvement in elderly individuals with long-standing progressive MS may provide valuable observational insights. The present report describes a hypothesis-generating clinical observation of functional improvement following a short, non-invasive, non-pharmacological, device-free intervention program.

Case Report

A 75-year-old retired businessman presented with long-standing neurological disability consistent with secondary progressive MS (SPMS).

Neurological symptoms began at the age of 55 years, with intermittent lower-limb spasm and gait instability. Over the following two decades, neurological function gradually deteriorated. Although brief partial remissions occurred earlier in the disease course, recovery remained incomplete, and disability accumulated progressively. A formal diagnosis of MS was established at the age of 65 years.

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At presentation, the patient reported the following symptoms:

- Severe fatigue
- Imbalance
- Lower-limb spasticity
- Numbness and paresthesia
- Tremor
- Neuropathic pain
- Heat sensitivity
- Urinary urgency with nocturia (5-6 episodes per night) caused chronic sleep disruption
- Cognitive complaints included subjective cognitive slowing and mental fog
- Ambulation was limited to cane-assisted walking, accompanied by a fear of falling

Neurological examination demonstrated the following findings:

- Spastic gait
- Bilateral lower-limb weakness
- Tremor affecting fine motor tasks
- Positive Romberg sign
- Bilateral extensor plantar responses

Global disability, assessed using the composite disability and functional status scale (CDFSS), was 29/50.

The CDFSS is a clinician-administered, multidomain disability scale developed in our clinic to assess neurological disability across three domains:

- Physical disability score (0-20)
- Cognitive-psychological score (0-20)
- Functional status (0-10)

Unlike the Expanded Disability Status scale, which is heavily weighted toward ambulation, the CDFSS provides a broader multidomain assessment of physical, cognitive, and functional status.

Baseline findings and outcome measures are summarized in Table 1.

Intervention [Somatic-neuropsychological Adaptive Programming System (SONAPS) Program]

The patient completed eight intervention sessions over approximately 60 days. A schematic overview of the patient's clinical timeline is presented in Figure 1. The intervention was non-invasive, non-pharmacological, and device-free. The SONAPS is a clinic-developed intervention framework designed to facilitate systemic functional regulation across physical—structural—functional and psychological—behavioral—cognitive domains. The approach operates within a real-time, closed-loop clinical framework in which patient responses during structured tasks are continuously monitored and used to guide adaptive adjustments in task sequencing.

Sessions included the following components:

- Structured symptom review
- Observational functional assessment
- Individualized, multimodal sensorimotor tasks

Rather than directly targeting isolated symptoms, the intervention aimed to improve systemic functional regulation.

For example, during early sessions, the patient demonstrated the following:

- Inability to independently button clothing
- Tremor during mobile phone use
- Reduced voice intensity
- Impaired balance

Following adaptive task sequences involving posture control, sensory feedback, and coordinated motor engagement, improvements in fine motor control were observed.

Functional performance was documented using video recordings obtained with patient consent.

Outcome Measures

Symptom severity ratings were obtained using a structured 0-10 scale, where:

Table 1. Prespecified outcomes before and after SONAPS

Domain	Measure	Baseline	Postintervention
Disability	CDFSS (0-50)	29	3
Strength	MRC LL-left (0-5)	1	3
Strength	MRC LL-right (0-5)	2	4
Neurologic signs	Romberg	Positive	Negative
Neurologic signs	Babinski	Upgoing	Neutral/downgoing

SONAPS: Somatic-neuropsychological adaptive programming system, CDFSS: Composite disability and functional status scale

- 0 indicates the absence of symptoms
- 10 indicates the worst imaginable symptom severity

Ratings were obtained through structured patient interviews.

Outcomes

Following the intervention program, global disability decreased substantially, with CDFSS scores improving from 29/50 to 3/50 postintervention. Lower-limb strength improved bilaterally on the Medical Research Council scale.

Neurological examination demonstrated the following:

- Conversion of Romberg sign from positive to negative
- Babinski responses becoming neutral or intermittently downgoing

Changes in neurological findings are summarized in Table 1. Symptom improvements are illustrated in Figure 2A, whereas changes across CDFSS domain scores are illustrated in Figure 2B.

Discussion

Sustained functional improvement in elderly individuals with long-standing SPMS is uncommon due to the disease's underlying biology, which is dominated by chronic neurodegeneration and limited reparative capacity (1,3).

Neuroplasticity declines with advancing age and prolonged disease duration, further restricting recovery potential in progressive neurological disorders (2). Nevertheless, emerging research suggests that neural systems may retain some adaptive capacity even in long-standing disease states.

Studies of functional brain connectivity indicate that large-scale neural networks remain dynamically modifiable and may respond to structured sensorimotor engagement and behavioral inputs (3,4).

Rehabilitation interventions in progressive MS have traditionally focused on domain-specific improvements, such as gait training, balance exercises, or fatigue management. Previous multimodal rehabilitation programs have generally reported modest, domain-limited benefits (5-7).

In contrast, the present observation suggests the potential for broader, multidomain functional improvement within a closed-loop adaptive intervention framework.

The SONAPS approach emphasizes real-time adjustment of sensorimotor and behavioral tasks based on ongoing patient responses, aiming to facilitate systemic functional regulation rather than targeting isolated symptoms.

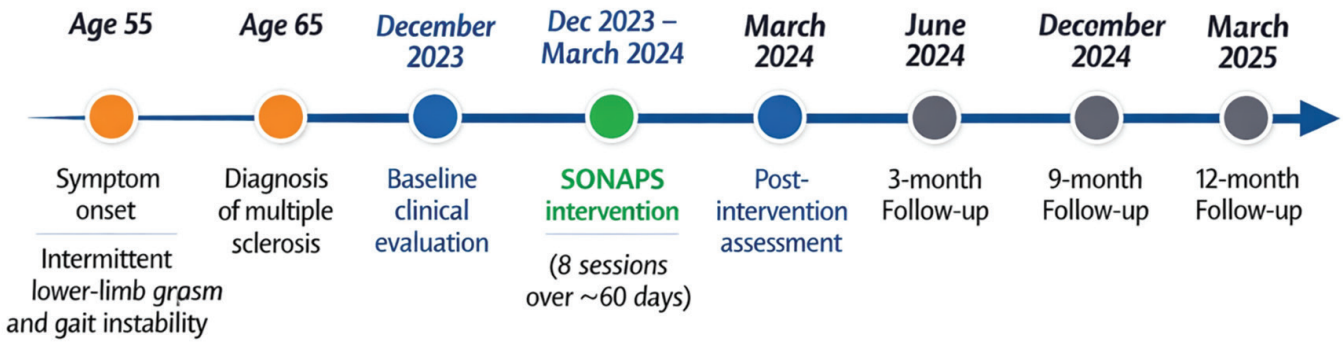

Figure 1. CARE timeline of the patient's clinical course from symptom onset to follow-up after the SONAPS intervention

Age 55: Symptom onset

Age 65: Diagnosis of MS

December 2023: Baseline clinical evaluation

December 2023 - March 2024: SONAPS intervention (8 sessions over ~60 days)

March 2024: Postintervention assessment

June 2024: 3-month follow-up

December 2024: 9-month follow-up

March 2025: 12-month follow-up

SONAPS: Somatic-neuropsychological adaptive programming system, MS: Multiple sclerosis

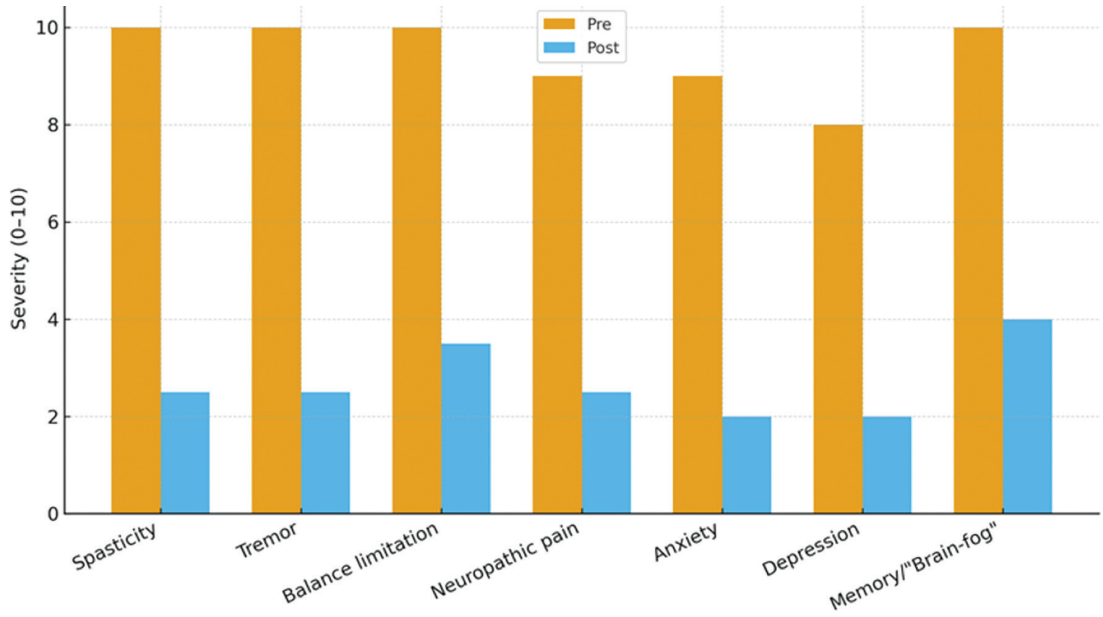

Figure 2A. Selected symptom severity scores (pre- vs. post-intervention)

PSF: Physical-structural-functional domain, PBC: Psychological-behavioral-cognitive domain

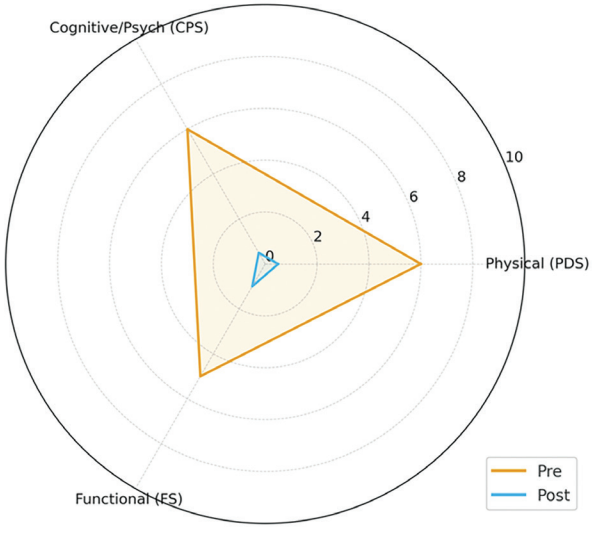

Figure 2B. Changes in CDFSS subscale scores, normalized to a 0-10 scale

CDFSS: Composite disability and functional status scale, PDS: Physical disability score, CPS: Cognitive-psychological score, FS: Functional status

Note: Error bars are not shown due to the single-case design

To our knowledge, sustained multidomain functional improvement of this magnitude in an elderly patient with long-standing SPMS has rarely been reported (1,4).

However, alternative explanations—including placebo effects, regression to the mean, or non-specific therapeutic influences—cannot be excluded.

Therefore, this report should be interpreted as a hypothesis-generating clinical observation that may inform future controlled studies.

Study Limitations

Several limitations should be acknowledged. First, this report describes a single, non-blinded case, and causal relationships cannot be established. Second, objective gait metrics and neuroimaging data were unavailable.

Third, several outcomes relied on patient-reported symptom ratings, which may be subject to reporting bias.

Additionally, the 0–10 symptom severity scales have not been validated for clinical responsiveness.

Fourth, the CDFSS has not yet undergone external validation.

Transparency and Independent Evaluation

To support transparency, video documentation of functional performance before and after the intervention sessions was obtained with patient consent. Short and extended video materials illustrating representative functional changes can be made available to reviewers upon request. Independent clinical evaluation by external investigators interested in examining the intervention under controlled research conditions is also welcome.

Conclusion

This case describes sustained multidomain functional improvement in a 75-year-old patient with late-onset SPMS following a short, device-free intervention program. These findings should be interpreted as hypothesis-generating clinical

observations rather than evidence of treatment efficacy. Further controlled and independently replicated studies are required.

Ethics

Informed Consent: Written informed consent was obtained from the patient and participating family members for the publication of clinical information and video documentation.

Footnotes

Authorship Contributions

Surgical and Medical Practices: H.N., Concept: H.N., A.R., Design: H.N., Data Collection or Processing: H.N., Analysis or Interpretation: H.N., Literature Search: H.N., A.R., Writing: H.N., A.R.

Conflict of Interest: No conflict of interest was declared by the authors.

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