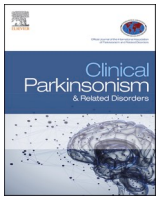
PRDOA 15 (2026) 100514

Contents lists available at ScienceDirect

Clinical Parkinsonism & Related Disorders

journal homepage: www.sciencedirect.com/journal/clinical-parkinsonism-and-related-disorders



Somato-cognitive coordination therapy using virtual reality in a patient with corticobasal syndrome

ARTICLE INFO

Keywords:
Corticobasal syndrome
Somato-cognitive coordination therapy
Virtual reality
Somato-cognitive action network
Case report

Corticobasal syndrome (CBS) is a progressive neurodegenerative clinical syndrome characterized by asymmetric parkinsonism, cortical sensory loss, apraxia, dystonia, myoclonus, and behavioral and cognitive impairment. A curative disease-modifying therapy for CBS has not yet been established. Considering the broad spectrum of clinical manifestations of CBS, symptomatic therapeutic approaches that can simultaneously address multiple symptoms are needed.

Somato-cognitive coordination therapy (SCCT) is a virtual reality (VR)-guided rehabilitation approach. The novelty of SCCT lies in its conceptual design aiming to target potential abnormalities within the somato-cognitive action network (SCAN) and simultaneously provide a unified therapeutic approach for multiple symptoms [1–3]. Herein, we report a patient with CBS who underwent three 20-min sessions of SCCT.

A 74-year-old male patient had a 3-year history of impaired left-hand dexterity and ambulatory dysfunction. Neurological examination revealed mild dysarthria, postural myoclonus, left upper-limb levitation, alien limb phenomena, and left-predominant clumsy limb/limb-kinetic apraxia involving both upper extremities. Parkinsonism, including rigidity and bradykinesia, was observed with left-sided predominance. Agraphesthesia was noted in both upper extremities.

The neurological examination results met the diagnostic criteria for CBS. Right-predominant bilateral frontoparietal atrophy over the cerebral convexities was found on brain magnetic resonance imaging (Fig. 1A). Dopamine-transporter single-photon emission computed tomography revealed a mildly reduced tracer uptake in the bilateral striata (Fig. 1B).

SCCT comprised three 20-min outpatient sessions performed 2 weeks apart. Under the guidance of a certified SCCT interventionist, a physician delivered the therapy using the mediVR KAGURA (mediVR Inc., Toyonaka, Japan), a VR technology-based medical device. A key feature of SCCT was letting patients alternate reaching tasks between the right and left hands toward static targets in the VR space while seated [2,3]. Clinical outcomes were assessed using the Movement Disorder Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS) Part III [4] and the 9-hole peg test [5] before each SCCT session (baseline, V1, and V2) and at 2 months after the third session (V3) (Fig. 1C). The 9-hole peg test was only used to assess the right hand because the left hand was untestable. The MDS-UPDRS Part III score improved progressively from 45 at baseline to 36 at V1 and 29 at V2. At the 2-month follow-up after the third session (V3), the score was 35, indicating that the clinical improvement was partially maintained (Supplementary Table 1). Rigidity improved progressively over the two SCCT sessions. The hand movements in both upper limbs improved after the first session, and left-sided toe tapping improved after the second session. Although not captured by the MDS-UPDRS Part III score, involuntary movements including the alien limb phenomenon, levitation, and mirror movements also showed improvement (Video 1). The performance on the 9-hole peg test exhibited a slight improvement, with completion times decreasing from 49.2 s at baseline to 45.0 s at V1 and 44.0 s at V2. No VR-induced sickness, such as nausea, dizziness, or headache associated with exposure to the VR environment, was observed, and no adverse events, including falls during the sessions, occurred.

SCCT may be a safe option and may provide clinical benefits even after a single 20-min session. In the current case, three 20-min SCCT sessions administered at 2-week intervals in an outpatient setting were completed without adverse events. Stepwise improvements in objective clinical outcome measures was observed after each session. After the two sessions (V2), the MDS-UPDRS Part III score decreased from 45 to 29, accompanied by improvements in clumsiness, involuntary movements, and parkinsonism. Notably, these clinical benefits were partially sustained for 2 months after the sessions (V3). Similarly, based on a previous study, a patient with Huntington's disease reported sustained and consistent improvements in objective clinical outcome measures throughout the whole 20-month intervention period, during which 30-min SCCT sessions were administered approximately once monthly [3]. In cerebellar ataxia that developed after treatment for pediatric brain tumors, even a single 10-min SCCT session is associated with changes in objective clinical outcome measures, accompanied by diffusion tractography changes that persisted for up to 5 months after the single intervention [6]. For adults, each session is generally conducted for approximately 20–30 min, with consideration given to the individual's level of fatigue. Regarding the interval between sessions, given that CBS is a chronic progressive neurodegenerative disorder, we selected a two-week interval as a feasible and sustainable schedule in the

https://doi.org/10.1016/j.prdoa.2026.100514
Received 1 September 2026; Received in revised form 28 September 2026; Accepted 19 October 2026
Available online 20 October 2026
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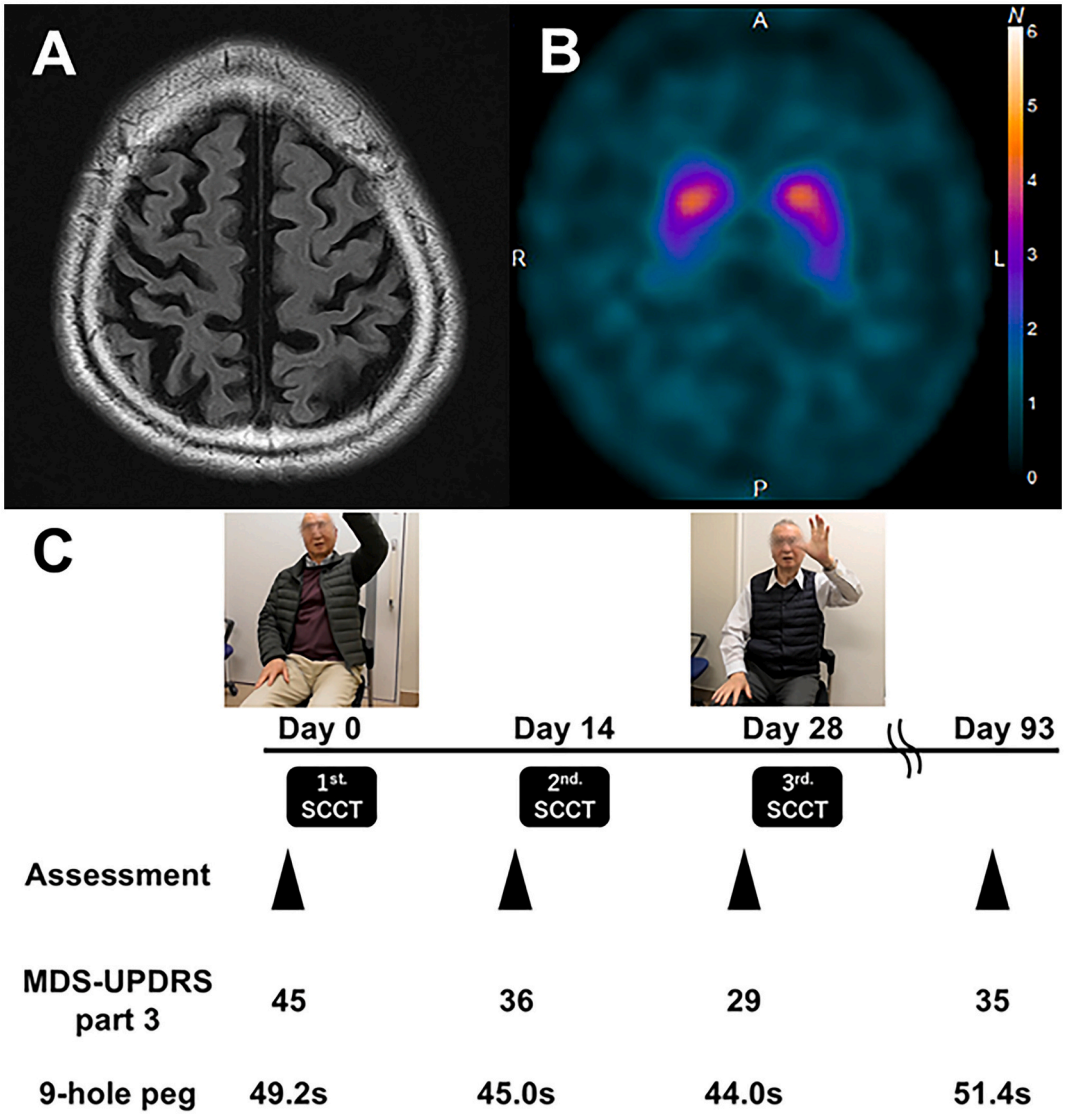

Fig. 1. Brain imaging and timeline of somato-cognitive coordination therapy.
(A) An axial fluid-attenuated inversion recovery image on brain magnetic resonance imaging revealed right-predominant bilateral frontoparietal atrophy over the cerebral convexities. (B) Dopamine-transporter single-photon emission computed tomography showed a mildly reduced tracer uptake in the bilateral striata, predominantly on the right. (C) The left upper-limb levitation observed at baseline was no longer present at 2 weeks after the second SCCT session (Video 1).

outpatient setting. Further studies are needed to determine the optimal session frequency for individual diseases and clinical conditions.

The clinical changes observed in this case across multiple motor manifestations may be associated with SCCT implementation, which is consistent with previous reports indicating its multi-domain therapeutic benefits across different neurological conditions [2,3,6]. In a previous report, a patient with CBS exhibited hypometabolism in the inter-effector regions constituting the SCAN on brain fluorodeoxyglucose positron emission tomography, thereby supporting the conceptual rationale for SCCT in targeting these potential network abnormalities [7]. This report has several limitations. First, as it is a single case report, the potential influence of placebo effects, evaluator bias, or practice effects could not be completely ruled out. Second, changes in the SCAN before and after SCCT were not objectively evaluated, leaving the underlying mechanisms speculative.

In conclusion, SCCT can be delivered in a short session in the outpatient setting while simultaneously addressing multiple symptoms with no observed adverse events. Hence, it represents a potential investigational, non-pharmacological VR-guided rehabilitation approach for patients with CBS, which requires further systematic evaluation in larger, controlled studies before its therapeutic efficacy can be established.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.prdoa.2026.100514.

Ethical compliance statement

The authors confirm that approval by an institutional review board was not required for this work. Written informed consent for publication of this case report and the accompanying images and video was obtained from the patient.

CRediT authorship contribution statement

Atsuhiko Sugiyama: Writing – original draft, Visualization, Investigation, Conceptualization. **Masahiko Hara:** Writing – review & editing, Visualization, Methodology, Conceptualization. **Yuki Nakagawa:** Writing – review & editing, Investigation. **Yui Murakawa:** Writing – review & editing, Visualization. **Ryota Kuroiwa:** Writing – review & editing, Investigation. **Masahiro Mori:** Writing – review & editing,

Supervision.

Ethics declaration

Written informed consent to take part in the study and to publish the article has been obtained from all participants or their legal representatives. The privacy rights of participants have been observed.

This study was performed in compliance with relevant laws, regulatory frameworks and guidelines where the research took place.

Ethics committee approval was not required under relevant laws and institutional guidelines. The authors confirm that approval by an institutional review board was not required for this work.

This research follows the CARE guidelines and the CARE checklist.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: mediVR KAGURA is a medical device of mediVR Inc. M.H. (co0-author) is a director of mediVR Inc., and holds equity in the company. Y.M. (co-author) is a full-time employee of mediVR Inc., and holds stock options in the company. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

We want to thank the patient for allowing us to share findings from his case for research and educational purposes. We would like to thank ENAGO (www.enago.jp) for the English language review.

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