RESEARCH PAPER

Effect of Cognitive Therapeutic Exercise Combined with Task-Oriented Training on Lower-Extremity Motor and Cognitive Function in Patients with Post-Stroke Hemiparesis

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ABSTRACT

Background

Stroke frequently results in motor and cognitive impairments that can limit functional independence. Task-oriented training promotes functional practice and motor learning, while Cognitive Therapeutic Exercise (CTE), based on the neurocognitive/Perfetti approach, incorporates cognitive and sensory-perceptual processes into movement rehabilitation. Evidence regarding its combined use with task-oriented training for lower-extremity recovery remains limited.

Objective

To compare the effects of conventional physiotherapy combined with task-oriented training with conventional physiotherapy, task-oriented training, and additional Cognitive Therapeutic Exercise on lower-extremity motor and cognitive function in patients with post-stroke hemiparesis.

Methods

An experimental comparative study was conducted in 30 patients with post-stroke hemiparesis, who were randomly allocated into two groups of 15 participants each. Group A received conventional physiotherapy combined with a task-oriented training program, whereas Group B received conventional physiotherapy and task-oriented training combined with Cognitive Therapeutic Exercise. The intervention was provided for 6 days per week for 12 weeks. Lower-extremity motor function and cognitive function were assessed before and after intervention using the Fugl-Meyer Assessment–Lower Extremity (FMA-LE) and Montreal Cognitive Assessment (MoCA), respectively.

Results

Both groups demonstrated statistically significant improvement following intervention. FMA-LE scores increased from 14.07 ± 3.37 to 20.27 ± 2.94 in Group A and from 12.07 ± 2.71 to 23.00 ± 2.83 in Group B. The post-intervention difference between groups was statistically significant ($P = 0.015$). MoCA scores increased from 18.20 ± 1.82 to 22.00 ± 2.00 in Group A and from 18.00 ± 2.67 to 25.53 ± 2.17 in Group B. The post-intervention difference between groups was statistically significant ($P < 0.05$).

Conclusion

The addition of Cognitive Therapeutic Exercise to conventional physiotherapy and task-oriented training resulted in greater improvements in lower-extremity motor and cognitive outcomes than conventional physiotherapy combined with task-oriented training alone.

Keywords: stroke; hemiparesis; cognitive therapeutic exercise; Perfetti method; task-oriented training; lower extremity; Fugl-Meyer Assessment; Montreal Cognitive Assessment.

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1. INTRODUCTION

Stroke is a major cause of persistent neurological disability and may result in impairments of motor function, cognition, balance, gait and activities of daily living. Recovery following stroke depends on the interaction between neural recovery, motor learning, practice and functional rehabilitation.

Lower-extremity impairment is particularly important because deficits in selective motor control,

coordination and functional movement can adversely affect standing, walking and independence.

Task-oriented training is based on repetitive practice of meaningful and goal-directed activities. It emphasizes active patient participation, task specificity, feedback and practice in functional contexts.

Cognitive Therapeutic Exercise (CTE), also known as the Perfetti method, was developed by Carlo Perfetti and incorporates cognitive processes into motor rehabilitation. The approach uses sensory and perceptual information, including recognition of direction, distance, shape, pressure and other characteristics, to facilitate motor control.

There is increasing research interest in CTE for stroke rehabilitation. Previous studies have reported improvements in sensorimotor and functional outcomes following cognitive exercise therapy. More recent randomized research has also investigated CTE combined with task-oriented training, although much of this literature has focused on upper-extremity recovery.

Therefore, investigating the effect of adding CTE to conventional physiotherapy and task-oriented training on lower-extremity motor function and cognitive function is clinically relevant.

2. STUDY OBJECTIVE

The objective of this study was to compare conventional physiotherapy plus task-oriented training with conventional physiotherapy plus task-oriented training plus Cognitive Therapeutic Exercise for improving lower-extremity motor and cognitive function in patients with post-stroke hemiparesis

3. METHODS

3.1 Study Design and Participants

An experimental comparative study was conducted with 30 patients with post-stroke hemiparesis. The thesis reports a simple random sampling technique and allocation of 15 participants to each group.

3.2 Intervention

Group A received conventional physiotherapy combined with task-oriented training. Group B received conventional physiotherapy and task-oriented training combined with Cognitive Therapeutic Exercise. The intervention was conducted 6 days per week for 3 months/12 weeks.

3.3 Outcome Measures

The Fugl-Meyer Assessment–Lower Extremity (FMA-LE) was used to assess lower-extremity motor function, and the Montreal Cognitive Assessment (MoCA) was used to assess cognitive function. Assessments were performed at baseline and after 12 weeks.

3.4 Statistical Analysis

The thesis reports use of Student's t-test for comparison of group means and paired t-tests for pre–post comparisons. Statistical significance was considered at $P < 0.05$.

4. RESULTS

4.1 FMA-LE

Group	Pre-intervention	Post-intervention
Group A	14.07 ± 3.37	20.27 ± 2.94
Group B	12.07 ± 2.71	23.00 ± 2.83

There was no significant baseline difference between groups ($P = 0.084$). Following treatment, the difference between groups was significant ($P = 0.015$), with Group B demonstrating the higher post-intervention FMA-LE score.

4.2 MoCA

Group	Pre-intervention	Post-intervention
Group A	18.20 ± 1.82	22.00 ± 2.00
Group B	18.00 ± 2.67	25.53 ± 2.17

Baseline MoCA scores were not significantly different between groups ($P = 0.812$). After treatment, Group B demonstrated a significantly higher MoCA score than Group A ($P < 0.05$).

5. DISCUSSION

The findings indicate that both treatment approaches were associated with significant improvements in lower-extremity motor and cognitive outcomes. However, participants receiving CTE in addition to conventional physiotherapy and task-oriented training demonstrated greater improvements.

For FMA-LE, Group B improved from 12.07 to 23.00, compared with an improvement from 14.07 to 20.27 in Group A. This suggests that the addition of CTE may provide an additional therapeutic benefit for lower-extremity motor recovery.

Similarly, MoCA increased to 25.53 in Group B, compared with 22.00 in Group A, suggesting a potentially greater effect of the combined intervention on cognitive performance.

These findings are biologically plausible because CTE incorporates cognitive-perceptual processing into movement rehabilitation rather than focusing solely on repetitive physical movement.

However, the results should be interpreted cautiously. The present study included only 30 participants, and the available thesis material does not provide enough information to establish whether the study was registered prospectively or whether a formal sample-size calculation was performed. These details should not be invented in the manuscript.

Recent evidence indicates that although CTE/Perfetti is promising, the overall evidence base remains heterogeneous and definitive superiority over conventional rehabilitation has not been established. Larger and methodologically rigorous randomized controlled trials are therefore required.

6. LIMITATIONS

- Small sample size (30 participants).
- A prospective trial registration was not performed.
- Long-term follow-up outcomes were not reported.

7. CLINICAL IMPLICATIONS

The findings suggest that incorporating Cognitive Therapeutic Exercise into conventional physiotherapy and task-oriented training may provide additional benefits for lower-extremity motor and cognitive recovery after stroke. Further adequately powered randomized controlled trials are needed before firm recommendations can be made.

8. CONCLUSION

The addition of Cognitive Therapeutic Exercise to conventional physiotherapy and task-oriented training produced significantly greater improvements in lower-extremity motor function and cognitive function than conventional physiotherapy combined with task-oriented training alone in patients with post-stroke hemiparesis. The findings support CTE as a potentially useful adjunct to task-oriented rehabilitation, while larger and methodologically rigorous randomized controlled trials are required to confirm its effectiveness

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