Effectiveness of Brief Executive Functions-Based Cognitive Remediation in Inpatient Males with Schizophrenia

Abstract

Context: Executive functions deficit is one of the hallmark impairments seen in persons with schizophrenia and is also linked with their functional outcome. Aims: The present study was designed to assess the effect of targeted cognitive remediation (CR) on executive functions and psychopathology in persons with schizophrenia. Settings and Design: This was a preliminary intervention study based on quasi-experimental design. Subjects and Methods: A CR module targeting executive functions was designed. Six persons with schizophrenia who underwent 4 weeks of individual executive functions-based CR were compared with matched control treatment as usual (TAU) group on Wisconsin Card Sorting Test (WCST), Mini-Mental State Examination (MMSE), and Positive and Negative Syndrome Scale (PANSS). Statistical Analysis Used: Between-group comparisons were made through Mann–Whitney U-test. Within-group pre-post analysis was made through Wilcoxon signed-rank test. Results: Post-1-month comparison on PANSS subscales, MMSE and WCST nonperseverative error showed insignificant group differences. However, participants in the intervention group committed significantly less perseverative error and completed more category sets on WCST in comparison to TAU. Conclusions: One-month CR targeting executive functions was found to be effective in improving cognitive flexibility. Despite a small sample, findings emphasize the need for including CR in the regular management of persons with schizophrenia.

Keywords: Cognitive remediation, executive functions, schizophrenia

Introduction

Neurocognitive deficits are one of the core impairments in schizophrenia.\(^1\) Extent of deficit is evident from the fact that even individuals with first episode schizophrenia, manifest significant neurocognitive impairments.\(^2\) Hence, in the last two decades, there has been a wave of cognitive remediation (CR) studies focused at developing therapeutic modules targeting neurocognitive deficits in persons with schizophrenia. Studies have shown that CR leads to improvement in neurocognition, psychosocial, and occupational functioning in persons with schizophrenia.\(^3,4\) Executive functions, an important component of neurocognition, are also severely affected in persons with schizophrenia. These deficits have also been found to affect the functional outcome.\(^5,6\) Hence, it is important to assess the effect of CR targeting executive functions on cognition and psychopathology. The present study aimed at assessing the effect of 1-month targeted CR on executive functions and psychopathology in persons with schizophrenia.

Subjects and Methods

An interventional study based on quasi-experimental design was conducted at the indoor facility of Lokpriya Gopinath Bordoloi Regional Institute of Mental Health (LGBRIMH), Tezpur, Assam, and therefore, only inpatients were recruited for participation. Six persons (males) diagnosed with paranoid schizophrenia \((n = 6)\) as per the International Classification of Diseases, Clinical Description and Diagnostic Guidelines (WHO)\(^8\) were selected for the present study as the interventional group which received CR as well as pharmacological treatment. A control group diagnosed with paranoid schizophrenia \((n = 6)\) was matched on age, gender, education, duration of illness, and duration of untreated psychosis. The inclusion criteria for both the groups

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included patients with active psychopathology, age range between 18 and 40 years, and formal education of at least 6 years. To select symptomatic patients, participants were required to have a score of ≥3 on one or more selected Positive and Negative Syndrome Scale (PANSS) items (of P1, P2, P3, N1, N4, N6, G5, and G9). The exclusion criteria for both the groups included intellectual disability, history of neurological illness, comorbid psychiatric illness, substance dependence, and electroconvulsive therapy in the past 6 months. All the patients were receiving antipsychotic medication. Mean chlorpromazine equivalent dosage at the time of admission is provided in Table 1. Medication dosages of the participants were adjusted as per requirement during their hospital stay. The study was approved by the Scientific Research Committee and Ethics Committee of LGBRIMH, Tezpur.

**Tools**

PANSS was used for the assessment of psychopathology. Mini-Mental State Examination (MMSE) was applied for the assessment of baseline cognitive functioning. For the assessment of executive functioning, Wisconsin Card Sorting Test (WCST) was applied.

**Remediation therapy**

The retraining focusing on executive functions was spread over 4 weeks, with a total of 16 sessions. The organization of the executive function tasks was such that in each week some new tasks were introduced as well as a higher difficulty level of a previously introduced task was added. The tasks of executive function-based retraining relied on the strategic coaching method of rehabilitation which focuses at learning to generate solutions to problems. In the present case, participants were first coached the possible ways with which a task could be approached and then develop strategies on their own to deal with subsequent problems. Thus, patients were taught executive functions skills through each retraining task, which had a higher ecological validity. In the 1st week, the focus was on preparation/task engagement, planning, and chunking. The 2nd week targeted on mental adaptability, prioritizing tasks, time judgment, time management, and higher tasks of planning. The 3rd week focused on imparting skills to understand oneself, largely in terms of identifying one’s characteristics, strengths, capabilities, and charting out one’s short-term and long-term goals. The final week required the patients to utilize the skills acquired in the previous weeks in terms of arriving at more concrete tasks. The target skills which were taught required patient to have self-preparation, self-directed action, and applying the skills of monitoring oneself, specifically in the context of the short-term goals that the patient had prepared in the previous week. All the tasks were paper-pencil based requiring the participants to think and write down their strategies to execute the job assigned to them.

| Table 1: Sociodemographic and clinical details (mean and standard deviation/observed frequency and percentage) |
|---------------------------------------------------------------|
| **Intervention**                                                                 | **Control**                                                                 | **U/FET** |
| **group (n=6)**                                                                 | **group (n=6)**                                                                 |           |
| Age                                                            | 31.33±2.34                                                                  | 28.50±5.58 | 10.50 |
| Marital status                                                 |                                                                              |            |
| Unmarried                                                      | 4 (66.7)                                                                    | 6 (100)    | P=0.45;FET |
| Separated                                                      | 2 (33.3)                                                                    | 0 (0)      |           |
| Religion                                                       |                                                                              |            |
| Hindu                                                          | 3 (50)                                                                      | 6 (100)    | P=0.18;FET |
| Muslim                                                         | 3 (50)                                                                      | 0          |           |
| Education                                                     | 12.17±2.32                                                                  | 12.83±3.10 | 16.50 |
| Age of onset                                                   | 21.83±5.98                                                                  | 20.50±3.27 | 15.00 |
| Duration of illness                                           | 9.33±7.55                                                                   | 7.83±6.37  | 15.50 |
| Duration of untreated psychosis                                | 7.17±3.92                                                                   | 7.17±4.07  | 18.00 |
| CPZ                                                            | 233.33±103.28                                                               | 225.00±98.74 | 17.50 |

SD=Standard deviation, U=Mann-Whitney U, FET=Fisher’s exact test, CPZ=Chlorpromazine equivalent dosage at the time of admission

**Procedure**

Participants in both the groups gave written informed consent to participate in the study. Baseline psychopathology assessment (PANSS) and cognitive assessments (MMSE and WCST) were conducted. Participants in the intervention group underwent four individual CR sessions in every week along with pharmacological treatment. Participants in the control group underwent only pharmacological treatment for a period of 1 month. Following a period of 1 month, post-assessment of psychopathology and cognitive functions were conducted. The study did not interfere with the usual treatment of the patients. Patients also participated in the weekly conducted group therapy sessions; however, it was made sure that all of them attended in order to control for a possible confound. Participants were also free to withdraw from the study at any given stage.

**Statistical analysis**

The between-group comparisons were made through Mann–Whitney U-test. Pre-post analysis was made through the Wilcoxon signed-rank test. The data was analyzed through IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, New York USA).

**Results**

The intervention and treatment-as-usual (TAU) groups did not differ significantly on sociodemographic and clinical variables [Table 1]. On baseline assessments, both the groups were comparable on PANSS subscales, MMSE, and WCST variables [Table 2 baseline]. The post-1-month comparison on WCST showed that the intervention group committed significantly less perseverative errors, gave
Table 2: Baseline and post-1-month mean and standard deviations of Positive and Negative Syndrome Scale, Mini-Mental State Examination, and Wisconsin Card Sorting Test (n=6)

|                  | Baseline Intervention Mean±SD | Baseline Control Mean±SD | Mann-Whitney U | Postintervention assessment Intervention Mean±SD | Postintervention assessment Control Mean±SD | Mann-Whitney U |
|------------------|-------------------------------|--------------------------|----------------|-----------------------------------------------|------------------------------------------|---------------|
| PANSS-P          | 17.68±2.80                    | 16.00±1.89               | 11.50          | 12.67±2.73                                    | 14.16±1.33                               | 10.00         |
| PANSS-N          | 13.33±3.14                    | 13.50±1.05               | 14.00          | 10.33±3.27                                    | 11.83±0.75                               | 9.50          |
| PANSS-G          | 29.33±4.68                    | 26.67±1.03               | 13.00          | 23.00±4.24                                    | 24.83±0.75                               | 7.00          |
| MMSE             | 26.17±2.64                    | 25.83±2.31               | 15.50          | 28.00±1.26                                    | 26.17±2.14                               | 8.00          |
| WCST-TC          | 61.67±11.81                   | 74.17±11.07              | 7.00           | 82.00±8.14                                    | 68.00±7.15                               | 3.50*         |
| WCST-PE          | 39.33±12.40                   | 31.33±13.12              | 12.00          | 19.67±9.58                                    | 39.17±20.04                              | 5.50*         |
| WCST-NPE         | 27.00±8.02                    | 17.50±5.36               | 7.00           | 11.33±4.84                                    | 13.83±6.31                               | 12.50         |
| WCST-CC          | 3.00±0.89                     | 3.83±1.33                | 11.00          | 5.33±0.81                                     | 3.67±1.21                                | 5.00*         |

*P<0.05. PANSS=Positive and Negative Syndrome Scale, PANSS-P=PANSS positive subscale, PANSS-N=PANSS negative subscale, PANSS-G=PANSS general psychopathology subscale, MMSE=Mini-Mental State Examination, WCST=Wisconsin Card Sorting Test, WCST-TC=WCST total correct, WCST-PE=WCST perseverative error, WCST-NPE=WCST non-perseverative error, WCST-CC=WCST categories completed, SD=Standard deviation

significantly more correct responses, and completed more categories compared to TAU control group [Table 2 postintervention].

However, significant differences were not observed on MMSE, PANSS subscales, and WCST non-perseverative errors on post-1-month assessment.

Paired sample pre-post within-group analyses were also conducted through Wilcoxon signed-rank test. The intervention group showed significant improvement on PANSS, positive (Z = −2.22, P = 0.03), negative (Z = −2.26, P = 0.03), and general (Z = −2.20, P = 0.03) subscales. They also committed significantly less perseverative (Z = −2.21, P = 0.03) and non-perseverative (Z = −2.20, P = 0.03) errors and completed significantly more WCST category sets (Z = −2.23, P = 0.03) post-1 month of intervention.

The pre-post analysis of control group only showed significant improvement on PANSS positive subscale (Z = −2.23, P = 0.03). Significant differences were not observed on other PANSS subscales, WCST, and MMSE on pre-post comparisons.

Discussion

The present study designed at studying the effect of brief CR targeting executive functions shows that persons with schizophrenia are benefited on a critical aspect of cognition called set shifting, suggesting improvement in cognitive flexibility. There are several important implications of the current findings. First is the brief duration of executive function-based CR leading to significant changes in the cognitive flexibility in the intervention group. A significant number of previous studies provided regular CR over several months which of course led to remarkable improvement in the cognitive functioning.[10,13,14] However, the present study highlights that even short duration of precise intervention can result into enhancement of executive functioning in persons with schizophrenia which is prominently affected. Similar findings were reported in a meta-analysis by McGurk et al.[3] who concluded that even short duration of intervention (5–15 h) is sufficient to enhance cognitive functioning.

Second is the impact of executive function-based CR on psychopathology of persons with schizophrenia. Effect of CR on psychopathology is inconclusive with some previous studies reporting improvement in positive[15] and negative symptoms,[16–18] whereas a few did not report improvement in psychopathology.[3] Moreover, previous meta-analytical studies[3,19] have reported a small-to-medium effect of CR on symptoms in persons with schizophrenia (d = 0.28, d = 0.18, respectively). Our findings although did not yield significant group differences in psychopathology on postassessment, but it was interesting to see that the CR group exhibited significantly less positive, negative, and general psychopathology symptoms on pre-post comparison. The control group only showed significant decrease in positive symptoms on pre-post assessment. Therefore, findings provide evidence that even brief CR facilitates improvement in psychopathology when combined with pharmacological and other treatments. One possibility for patients exhibiting improvement in psychopathology is that CR leads to improved cognitive flexibility and reasoning abilities in persons with schizophrenia, and therefore, they are in a position to analyze alternate explanations of psychotic symptoms such as delusions. Some researchers have also argued that CR leads to positive learning experience which enhances self-esteem, and therefore, can play an instrumental role in improving overall functioning.[3]

The present finding should be seen in light of the previous studies on CR in schizophrenia. Most of the studies reported significant improvement in cognitive functioning of patients, which is an important predictor for functional outcome in persons with schizophrenia. Our findings...
specifically show that even a brief CR targeted at the major deficits (executive functions in the present case) leads to significant improvement and therefore these interventions should be adopted as a part of regular management of patients with schizophrenia.

The present study had some major limitations. Firstly, the small sample size of the study limits generalization of the findings. Hence, similar studies with larger sample size based on randomized controlled design are required. Another limitation is that the impact on functional outcome was not assessed. However, since the present study included only inpatient participants and the period of intervention was brief, we did not expect much impact on functional outcome, and therefore, these variables were not included. Hence, the impact of the intervention in improving daily functioning should be seen in future research, and therefore, the present findings should be considered preliminary. Finally, the opinion of the participants about the intervention was not taken postintervention and hence should be considered for the future studies.

Conclusions

Executive functions-based CR was found to be effective in improving cognitive flexibility in persons with schizophrenia. However, future studies with larger sample assessing effectiveness of executive function-based CR on functional outcome needs to be conducted before generalizing the findings.

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Conflicts of interest

There are no conflicts of interest.

References

1. Heinrichs RW, Zakzanis KK. Neurocognitive deficit in schizophrenia: A quantitative review of the evidence. Neuropsychology 1998;12:426-45.
2. Mesholam-Gately RI, Giuliano AJ, Golf KP, Faraone SV, Seidman LJ. Neurocognition in first-episode schizophrenia: A meta-analytic review. Neuropsychology 2009;23:315-36.
3. McGurk SR, Twamley EW, Sitzer DI, McHugo GJ, Mueser KT. A meta-analysis of cognitive remediation in schizophrenia. Am J Psychiatry 2007;164:1791-802.
4. Spaulding WD, Reed D, Sullivan M, Richardson C, Weiler M. Effects of cognitive treatment in psychiatric rehabilitation. Schizophr Bull 1999;25:657-76.
5. Bilder RM, Goldman RS, Robinson D, Reiter G, Bell L, Bates JA, et al. Neuropsychology of first-episode schizophrenia: Initial characterization and clinical correlates. Am J Psychiatry 2000;157:549-59.
6. Addington J, Addington D. Neurocognitive and social functioning in schizophrenia: A 2.5 year follow-up study. Schizophr Res 2000;44:47-56.
7. Bryson G, Bell MD. Initial and final work performance in schizophrenia: Cognitive and symptom predictors. J Nerv Ment Dis 2003;191:87-92.
8. World Health Organization. The ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines. Geneva: World Health Organization; 1992.
9. Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. Schizophr Bull 1987;13:261-76.
10. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-98.
11. Heaton SK, Chelune GJ, Talley JL, Kay GG, Curtiss G. Wisconsin Card Sorting Test Manual: Revised and Expanded. Odessa, FL: Psychological Assessment Resources; 1993.
12. Eack SM. Cognitive remediation: A new generation of psychosocial interventions for people with schizophrenia. Soc Work 2012;57:235-46.
13. Wykes T, Reeder C, Corner J, Williams C, Everitt B. The effects of neurocognitive remediation on executive processing in patients with schizophrenia. Schizophr Bull 1999;25:291-307.
14. Penadés R, Catalán R, Salamero M, Boget T, Puig O, Guarch J, et al. Cognitive remediation therapy for outpatients with chronic schizophrenia: A controlled and randomized study. Schizophr Res 2006;87:323-31.
15. Wykes T, Reeder C, Landau S, Everitt B, Knapp M, Patel A, et al. Cognitive remediation therapy in schizophrenia: Randomised controlled trial. Br J Psychiatry 2007;190:421-7.
16. Revell ER, Neill JC, Harte M, Khan Z, Drake RJ. A systematic review and meta-analysis of cognitive remediation in early schizophrenia. Schizophr Res 2015;168:213-22.
17. Cella M, Preti A, Edwards C, Dow T, Wykes T. Cognitive remediation for negative symptoms of schizophrenia: A network meta-analysis. Clin Psychol Rev 2017;52:43-51.
18. Ventura J, Subotnik KL, Gretchen-Dooley D, Casaus L, Boucher M, Medalia A, et al. Cognitive remediation can improve negative symptoms and social functioning in first-episode schizophrenia: A randomized controlled trial. Schizophr Res 2019;203:24-31.
19. Wykes T, Huddy V, Cellard C, McGurk SR, Czobor P. A meta-analysis of cognitive remediation for schizophrenia: Methodology and effect sizes. Am J Psychiatry 2011;168:472-85.