Original Article

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Effect of Individual Cognitive Stimulation Therapy on Dementia and Quality of Life in Older Adults: A Quasi-experimental Study

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ABSTRACT

Introduction: Dementia is a chronic neurocognitive disorder that causes a decline in cognitive functions. As the global prevalence of dementia rises, non pharmacological therapies, such as Cognitive Stimulation (CS), have shown promise in preserving cognitive function and improving Quality of Life (QoL). Individual Cognitive Stimulation Therapy (iCST) offers an alternative intervention for those unable to participate in group therapies, often involving caregivers as facilitators.

Aim: To evaluate the effect of iCST on dementia in older adults and its impact on individual QoL.

Materials and Methods: This quasi-experimental trial, a pre-post study design was conducted in Marathwada, Aurangabad, Maharashtra, India, from September 26, 2023 to February 21, 2024. A total of 34 study participants, aged ≥60 years with mild to moderate dementia {Global Clinical Dementia Rating (CDR) score=1 or 2}, were included. Participants received iCST three times a week, with each session lasting 45 minutes, over a period of five weeks. After the completion of therapy, changes were noted using the Clinical Dementia Rating (CDR) scale and the Older People's Quality of Life (OPQoL) questionnaire. Data were analysed using the Shapiro-Wilk test and the dependent t-test.

Results: The results were statistically significant with respect to both measures. The mean difference of the CDR Scale and the OPQoL questionnaire score was 0.97±1.28 and 10.79±5.31, respectively which showed a statistically highly significant difference with a p-value <0.001.

Conclusion: The iCST program has shown efficacy in alleviating dementia symptoms and enhancing the QoL for individuals with mild to moderate dementia.

Keywords: Activity of daily living, Cognition, Neurocognitive, Neurodegenerative

INTRODUCTION

Dementia is a type of neurocognitive disorder that affects memory, self-care skills, judgment, language, comprehension, orientation, and learning ability. It is a chronic neurodegenerative condition that progresses over time [1]. Additionally, upto 90% of people with dementia experience behavioural and psychological symptoms, including delusions, sleep disturbances, depression, anxiety, irritability, apathy, and agitation [2,3].

Research suggests that neuropsychiatric side effects are linked to disease severity and contribute to its progression over time [4]. According to the World Health Organisation (WHO), dementia affects approximately 55 million individuals worldwide, with 5.4% of men over 65 years and 8.1% of women affected [5]. It is anticipated that this figure will rise to 78 million individuals by 2030 and 139 million individuals by 2050, presenting substantial financial, social, and caregiving challenges [5,6]. Research indicates that 7.4% of older adults in India have dementia, with women being more commonly affected in rural areas compared to urban areas [7].

Pharmacological and non pharmacological approaches are among the various therapies available for the treatment of dementia, with systematic studies indicating that non pharmacological therapies, such as reminiscence training, CS, rehabilitation, and multimodal stimulation, are effective for preserving cognitive function, managing Neuropsychiatric Symptoms (NPS), and enhancing QoL [8-10]. Most of these therapies work effectively and can be combined with pharmacological treatments [8,11].

The CS is a psychosocial approach that emphasises intellectual and social engagement through purposeful interaction activities and discussions, applicable in both group and individual settings [9-11]. iCST has remained relatively underexplored [10,12,13]. Furthermore, iCST provides an alternative form of intervention for individuals who cannot move or participate in group therapy programs. iCST is designed to be implemented wholly or partially by caregivers, who receive guidance, coaching, or supervision from a healthcare professional [10,13]. Spouses, family members, or friends can act as caregivers if they are involved in the intervention [12-15].

Recent systematic reviews indicate that individual cognitive interventions like iCST can improve cognitive functions such as problem-solving, attention, and immediate memory [9] and may also help postpone the need for institutional care for individuals with cognitive impairments [16]. Thus, the current study hypothesises that iCST may enhance cognition in older adults with dementia. The study aimed to evaluate the effect of iCST on cognition in older adults with dementia and assess its impact on their individual QoL.

MATERIALS AND METHODS

This quasi-experimental trial, a pre-post study design, was conducted in Marathwada, Aurangabad, Maharashtra, India, from September 26, 2023, to February 21, 2024. Ethical approval was obtained from the Institutional Ethical Committee (MGM/PHARMAC/ECRHS/2022/63). The study is registered with the Clinical Trial Registry of India (CTRI) under trial number CTRI/2023/04/051509. Informed consent from the participants was obtained prior to the trial through written confirmation.

Sample size calculation: The formula $n=(Z\alpha^2\times\sigma^2)\div d^2$ was utilised to calculate the sample size. This formula consists of $Z\alpha=1.645$ for a 90% confidence interval, $\sigma=0.53$ representing the standard deviation, and d=15%, which is the relative precision. The sample size was 34, with 85% statistical power and a 90% confidence interval, based on earlier studies. Participants were selected through non-probability convenience sampling [17].

Inclusion criteria: Participants must be atleast 60-year-old, of any gender, and able to follow instructions. They should live in care homes,

live independently, or reside with family. Participants must have mild to moderate dementia (Global CDR score=1 or 2) and be able to speak and understand the language used in the intervention [18].

Exclusion criteria: Participants with severe dementia (CDR ≥3), significant physical or psychiatric illnesses, and severe sensory impairments that limit participation were excluded. Additionally, individuals with aggressive behaviours a history of substance abuse, lack of caregiver support in home-based settings, or those who are non consenting or uncooperative were also excluded.

Study Procedure

The present study included 34 participants. Baseline characteristics were collected, and outcome measures were recorded by the therapist both before and after the intervention using the CDR Scale [18] and the OPQoL Questionnaire [19]. The CDR is determined through a semi-structured interview with patients and their informants. It evaluates the subject's cognitive status using six domains of cognitive and functional performance that are relevant to dementia: personal care, home and hobbies, memory, orientation, judgment and problem-solving, and community affairs. The CDR is based on a scale of 0 to 3, where 0 indicates no dementia, 0.5 indicates doubtful dementia, one indicates mild cognitive impairment, two indicates moderate cognitive impairment, and three indicates severe cognitive impairment. The CDR has shown a Cronbach's α of 0.83-0.84, demonstrating great internal consistency. The inter-rater reliability is κ 0.77-1.00 for the six domains and 0.95 for the global rating [18,19].

The OPQoL questionnaire comprises 35 statements. It covers aspects such as daily activities, confidence in performing activities, perception of memory, and ability to work. Lower scores on this scale indicate a poorer QoL. It demonstrates excellent reliability, with a Cronbach's alpha of 0.748-0.876. The OPQoL scale uses a 5-point Likert scale from strongly agree to strongly disagree, with scores ranging from 35 (QoL so bad it could not be worse) to 175 (QoL so good it could not be better) [20].

Based on previous literature protocols as described in [Table/Fig-1-5] [21], the physiotherapist begins the session with the first five minutes dedicated to working with clay. During this period, participants engage in activities at different complexity levels, ranging from Level 1 to Level 4. Following this, the next 10 minutes focus on drawing figures, categorised into two groups: Levels 1 to 3 and Levels 4 to 6, allowing for a progression in difficulty as the participants improve. Subsequently, the following ten minutes are allocated to number sequences, with activities divided into Level 1 and Levels 2 to 3 to cater to varying degrees of cognitive challenge. The final ten minutes concentrate on fine motor control exercises, targeting skills at Levels 1 to 2, with the patient participating for three weeks in Physiotherapy Outpatient Department (OPD) and completing the remaining sessions at home under caregiver supervision. These structured activities are designed to progressively enhance cognitive and motor abilities through engaging and appropriately challenging tasks [Table/Fig-6a-f].

Level 1	Level 2	Level 3	Level 4
Break off tiny pieces of clay; form the clay into cubes and small balls; create larger balls that can be squeezed for strengthening.	Shape the clay into various objects such as bowls and animals.	Roll the clay into rolls by rolling it out on a flat surface; use these rolls to create pots in various sizes and forms.	Shape the clay into pots and other artistic creations using a pottery wheel using clay and water.

[Table/Fig-1]: Working with clay.

The patients and caregivers were provided with detailed explanations of the exercises, which were subsequently demonstrated by a physiotherapist and performed by the patients for three weeks in the physiotherapy OPD. The caregivers were instructed to maintain a compliance diary for dependent participants to monitor the regularity

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Observe as you draw a basic shape, then request the individual to trace the outline using a different coloured pencil; repeat this activity with various shapes.	Draw a basic shape on a piece of paper, place another blank sheet over it, and instruct the subject to trace the shape through the top sheet. Repeat with different shapes.	Create a basic shape with dots on it, then ask the individual to join the dots to finish the shape. Repeat with different shapes.	Illustrate a shape on a sheet of paper and instruct the person to replicate it on another sheet; as their skills advance, introduce various shapes and eventually have them draw objects.	Instruct the subject to sketch items and shapes from memory without using a picture as a guide.	Instruct them to sketch three-dimensional objects completely from memory, without the need of a reference.

[Table/Fig-2]: Drawing figures.

Level 1	Level 2	Level 3
Count from 1 to 10 in order, repeating the exercise several times, and gradually extend the number range as the person advances.	Count from 1 to 10 using only odd or even numbers, alternating between the two sets and repeating the task several times as instructed.	Begin by stating the numbers in the sequence, then ask the participant to provide the subsequent numbers, alternating between addition and subtraction, and adjust the values to test their mental agility and arithmetic skills.

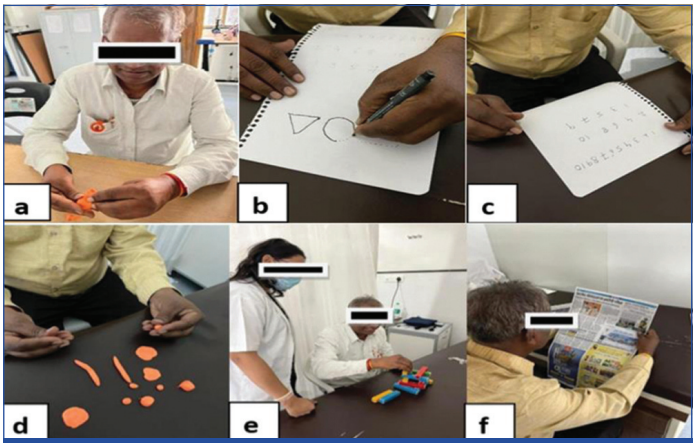
[Table/Fig-3]: Number sequences.

Level 1	Level 2	Level 3	Level 4
Assign the task of building the tallest tower possible using only their hand and the most power and dexterity. Make sure the pieces are placed for stability. Place several small blocks on a flat area.	Instruct the person to use their most skilled hand to carefully remove the top block from the stack, one at a time, without toppling the tower, and if feasible, repeat the task with their less dominant hand.	Place several small blocks on a flat surface and direct the person to use their hands to construct two distinct towers, making each as tall as possible.	Present the game of Jenga and instruct the person to carefully remove blocks from the tower without causing it to collapse.

[Table/Fig-4]: Fine motor control.

Level 1	Level 2	Level 3	Level 4
Request the person to read aloud numbers, letters, days of the week, and months.	Prepare index cards featuring single words or images of household objects, then present the card along with the corresponding object and a different one for the person to identify.	Have the person read a brief paragraph and then respond to questions regarding its content.	Provide them a book, magazine, or other comparable source to read aloud. Then, ask them questions about the content and make any necessary edits.

[Table/Fig-5]: Reading comprehension.



[Table/Fig-6]: Structured activities designed to enhance cognitive and motor abilities progressively.

of the exercises performed at home (date, time, number of sets, repetitions, rest period). In addition, independent patients maintained their own diaries. For the remaining two weeks, the iCST program was administered through weekly telecommunication sessions. These sessions aimed to monitor adherence, implement any necessary adjustments, and evaluate the need for progression based on the

current iCST level. The exercise dosage for iCST consisted of 45-minute sessions, three times per week over a period of five weeks.

STATISTICAL ANALYSIS

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 23.0, with the level of significance set at 0.05. The demographic data for gender and age distributions were calculated using the percentage method. The Shapiro-Wilk test assessed the normal distribution of all outcome measures. A dependent t-test was applied to the CDR Scale and the OPQoL Scale.

RESULTS

A total of 15 male and 19 female older adults with dementia were enrolled in present experimental study. The baseline characteristics of the participants are presented in [Table/Fig-7]. The study variables followed a normal distribution, as all variables showed non significant outcomes, indicating data homogeneity [Table/Fig-8]. The mean differences in CDR and OPQoL scores were 0.97±1.28 and 10.79±5.31, respectively, demonstrating a highly significant statistical difference with a p-value of <0.001 [Table/Fig-9].

Parameters		n (%)
Gender	Female	15 (44%)
	Male	19 (56%)
Age (years) (mean±SD)		75.5±6.04

[Table/Fig-7]: Demographic data including gender distribution and age distribution by using percentage method.

Variables	Time frame	z-value	p-value
1. Clinical Dementia Rating (CDR) scale	Pre	0.948	0.113
	Post	0.955	0.185
2. Older People's Quality of Life (OPQoL) scale	Pre	0.971	0.510
	Post	0.973	0.576

[Table/Fig-8]: The normality of outcome measures was assessed by Shapiro-Wilk test.
*A p-value of <0.05 was considered statistically significant

Variables	Pre	Post	Diff	Effect size	t-value	p-value
	Mean±SD	Mean±SD	Mean±SD			
1. Clinical Dementia Rating (CDR) scale	8.58±1.98	7.61±2.37	0.97±1.28	0.80	4.350	0.001*
2. Older People's Quality of Life (OPQoL) scale	95.06±12.47	105.85±11.96	10.79±5.31	2.03	11.676	0.001*

[Table/Fig-9]: Comparison of pretest and post-test scores of CDR and OPQoL by dependent t-test.
*A p-value of <0.05 was considered statistically significant

DISCUSSION

The present study evaluated the effect of iCST on older adults with dementia and its impact on their QoL. The findings demonstrate that iCST significantly improved dementia symptoms and enhanced the QoL in older adults with mild to moderate dementia, thus accepting the study hypothesis.

The observed cognitive improvements in older adults could be attributed to the preservation of cognitive skills that were previously underutilised due to a lack of social interaction, occupational engagement, and involvement in decision-making processes, similar to the study conducted by Quayhagen MP et al., [22]. Additionally, positive interactions with the physical therapist and caregiver during the intervention likely contributed to these improvements by fostering a pleasant and meaningful therapeutic environment, which is consistent with findings from the systematic review conducted by Valenzuela MJ and Sachdev P and the literature review by Van Mierlo LD et al., [23,24]. The present study focused on participants with mild to moderate cognitive impairment, who are likely more responsive to individualised interventions compared to those with severe dementia. Current research on neuroplasticity and neurogenesis indicates that individuals with less severe cognitive impairment exhibit higher neuroplastic capacity, learning ability, and potential for neurogenesis [25]. In addition, cognitive interventions should be introduced early in the progression of cognitive decline [10]. The present study showed that people with dementia had a better QoL when both the physical therapist/caregiver and the person with dementia were involved in the treatment, as demonstrated by the review of 57 randomised controlled trials conducted by Logsdon RG et al., [26]. Research indicates that maintaining a positive mood and engaging in enjoyable activities are crucial for the QoL in people with dementia. Additionally, other important factors to consider are the state of well-being, physical mobility, managing activities of daily living, and cognitive ability, in accordance with the study by Nyman SR and Szymczynska P [27]. Individual CS in older adults with dementia has been linked to improvements in cognitive function and a reduction in caregiver burden [28]. Including caregivers in psychological interventions can help them and the person with dementia understand each other better, communicate more effectively, and improve their relationship, providing a feeling of overall well-being [29]. Further studies can include a more diverse and larger sample size to improve the generalisability of findings on iCST. Investigating the long-term effects of iCST on cognitive decline and QoL will provide insights into its sustainability as an intervention. Additionally, exploring the use of technology for delivering iCST and examining its combination with other therapeutic approaches could enhance engagement and develop more comprehensive care strategies for dementia management.

Limitation(s)

Reliance on self-reported measures to assess QoL may introduce bias.

CONCLUSION(S)

The findings of present study underscore the effectiveness of iCST in enhancing cognitive function and QoL for older adults with dementia. By implementing iCST in both home and community settings, significant improvements were observed in cognitive symptoms and QoL, reinforcing its role as a valuable therapeutic intervention. The present study highlights iCST as a potential standardised approach in dementia care.

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