A Study To Explore The Efficacy Of Graded Cognitive Training Among Elderly Individuals With Mild Cognitive Impairment -A Randomized Controlled Trial

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Abstract

Study Design-Experimental Design

Aim- To find the efficacy of graded cognitive training among elderly individuals with mild cognitive impairment.

Objective- To Improve the cognitive impairment, ADL and quality of life.

Participants-113 subjects aged $\geqq 60$ years in the baseline survey, and 102 subjects with MCI who participated in the baseline survey.

Methods- A randomized control trial was conducted on 102 patients with mild cognitive impairment (MCI) from Apna ghar Ashram and Apni Sanskriti Charitable Foundation, Noida and shelter home in Ghaziabad. The total sample was randomly divided into two equal groups. Experimental group (N = 51) male=37, female=14 and a control group (N = 51) male=35, female=16. The control group was provided cognitive training, and the experimental group was administered graded cognitive training.

Results-After the intervention, the Experiment group shows a significantly higher mean cognitive score (25.59) compared to the Control group (21.37) (p = 0.001). The Experiment group shows a significant decrease in basic daily living activity scores post-intervention (29.57) compared to the Control group (37.73) (p = 0.001). Bristol activity of daily living (BADL) shows higher the score lowers the performance. Therefore, the activity of daily living improves after the 2 months of intervention. Post-intervention, the Experiment group shows a significantly higher mean quality of life score (63.02) compared to the Control group (49.44) (p = 0.001). Statistical test revealed a significant effect of the interaction between time and cognitive training on the total MOCA score.

Conclusion- Fifty-one participants in the experimental group improved to normal levels, and no participants progressed to dementia after two months of graded cognitive training. Thus, the efficacy of the intervention was statistically significant. The graded cognitive training intervention is effective and may help to decrease the deterioration of cognitive function, improve ADL and quality of life in patients with MCI, and the interaction between intervention time and graded cognitive training significantly improves cognitive function, ADL and quality of life.

INTRODUCTION:

The prevalence of moderate cognitive impairment (MCI) and cognitive decline in the elderly is a growing public health problem as the world's population ages. Between the more severe cognitive decline seen in dementia and the anticipated cognitive decline of aging normally, MCI is an intermediate stage. Finding efficient treatments for mild cognitive impairment (MCI) is essential because it provides a window of opportunity to postpone or stop the onset of dementia, maintaining people's quality of life and lessening the overall load on healthcare systems.[1]

Gradient cognitive training in particular has become known as a viable non-pharmacological technique for improving cognitive abilities in older adults. Gradually challenging tasks that are adapted to a person's present performance level are part of graded cognitive training[2]. The tasks are methodically structured. The brain's capacity to restructure itself by generating new neural connections throughout life is known as neuroplasticity, and it forms the theoretical foundation for this method. According to studies, these kinds of focused and flexible cognitive workouts can enhance executive, memory, and attention skills.[3]

This randomized controlled trial (RCT) is to investigate the effectiveness of graded cognitive training in older people with MCI. This study aims to provide strong evidence on the possible advantages of this intervention by carefully assessing cognitive outcomes in a controlled experimental setting. Although earlier studies have suggested that cognitive training may be beneficial, more excellent RCTs are required to draw firm conclusions regarding its effectiveness in MCI groups.[4]

Previous study obtained important ramifications for formulating strategies that sustain and enhance cognitive health in older adults. Effective therapies give promise for reducing the effects of cognitive decline on people and society at large, and they may also contribute to the larger aims of healthy aging and dementia prevention.[6] In this study graded cognitive training investigate improvement of cognitive impairment and quality of life as well as decrease dependency.

METHODOLOGY:

A total of 102 participants included in the study through randomization according to the convenient sampling divided into 2 groups experimental group and control group. In Experimental group (N = 51), thirty seven male and fourteen female out of fifty one are participated and in control group (N = 51), thirty five male and sixteen female are participated out of fifty one participants.

In experimental group Graded Cognitive Training was given to the participants for duration of 4 weeks, 5 sessions per week for 90 min. In control group conventional Cognitive Training was given to the participants for duration of 4 weeks, 5 sessions per week for 90 min. Participants were recruited from Apna Ghar Ashram Noida, Apni Sanskriti Charitable trust, Shelter home in and around Ghaziabad with eligibility criteria to meet inclusion criteria, Age above 60 yr, both male and female included, Individual with Educational qualification at least 10th grade, having MOCA Score below 26 and willing to participate in the study as per convenient sampling method. Excluded Individual with Brain tumours, Dementia and Active Epilepsy, Parkinson's disease, Unstable internal medical diseases that could influence brain function or cognitive function, History of acute cerebrovascular disease within three months, severe sensory impairment, History of mental illness. Prior to the study, participants were presented with a comprehensive informed consent form detailing the study's objectives, procedures, potential risks, and benefits. They were given ample opportunity, and explanation to review the document and ask questions before providing written consent. Each participant underwent a pre-assessment to establish baseline measurements using MOCA, BADL & WHO-QoL-B.

Outcome Measures:
1. Montreal Cognitive Assessment (MoCA):
The change in cognitive function as determined by the Montreal Cognitive Assessment (MOCA) is the main outcome measure for this study. The test procedures and the 30-point exam can be given in around 10 minutes. Working memory and attention, short-term memory recall, visuospatial skills, linguistic proficiency, and executive functions including divided attention, semantic fluency, and abstraction are among the cognitive functions that are tested. MoCA for use with specific populations, like the visually impaired[19] and

those with low educational attainment (LDS) have also been designed and validated.

The MoCA has been shown in a test validation study to be superior at detecting MCI and early AD [18], a significant point in the comparison with the MMSE. The sensitivity and specificity of the MoCA for detecting MCI (n=94) were 90% and 87% compared with 18% and 100% using the MMSE, respectively.

2. Bristol Activities of Daily Living (BADL):

Functional Independence Assessed by the Bristol Activities of Daily Living (BADL) scale. The BADL scale measures the ability of participants to perform daily tasks independently. Many scales have been developed for measuring activities of daily living, but few were specifically designed for individuals with mild dementia living in the community for completion by caregivers. Fewer still were designed with the assistance of caregivers themselves. The Bristol Activities of Daily Living Scale since its development and potential future changes. It also takes a longer look forwards at possible, more general advances in activities of daily living measurement.[22]

3. WHO Quality of Life-Bref (WHO QOL- Bref):

To evaluate the Quality of Life Briefly using the WHO Quality of Life-Bref (WHO QoL- Bref) scale, which assesses the overall quality of life from both the participant's and caregiver's perspectives.[16] 0 points represent the worst possible state of health, while 100 points represent the best possible state of health with regard to the respective domain. Thus, the patient's physical, psychological, social, and environmental state of health are assessed separately.

Treatment Protocol:
1. Experimental Group Intervention: Graded Cognitive Training

Sl.No.	Domain	Contents of Activity	Procedure	Duration	Gradation	Home program
1.	Memory training	1.Seven- piece board recovery training	-Wooden board having 7 replaceable different shapes, colours and detachable numbers. -Ask to the client to arrange it properly in that wooden frame.	9 min	-Arrange the shapes. -colours should be change in every week. -And number should be change in each interaction.	-Necessary things arrange in the room.
		2.Picture reading memory	-Flash card which is having different pictures based on different situation. -Client see the card and make a story on that picture.	9 min	-Each flash card having two parts. -2 cards having 4 parts ask them arrange the cards correctly and make story on that. -Gradually no of cards increases.	-Bibliography of old photo graphs of family members and friends. -See and remember that situation.
		3.Readin g aloud	-Newspaper reading.	6 min	-Increase paragraph and decrease time limit.	-Read books -Read medicine name. -Read mythological books
		4.Recitin g phrases	-What client should read in the newspaper reciting them.	6 min	-What he/she read loudly memorize those things.	-Remember a shopping and list. -Remember medication
2.	Attention training	1.Colour reaction training	1.Wooden electric board having different colors of light which is control by therapist and client only recognize the color name when therapist ask	15 min	-Use different color paper on the wooden board and make different new colors	-Decorate their homes -The color of the car they drive -Driving -Identify colors of clothes.
		2.Schulte Grid training	-Use Schulte table (alphabets)	15 min	-Use Schulte table (Both alphabets and numbers)	-Coin sequencing -Cooking -Vegetable cutting
3.	Calculation training	1. Two Simple Calculation questions.	Addition Substracti on	15 min	-Calculation should be change in each interaction	-Vegetable buying/Marketing
		2.One simple application question for calculation (each interaction)	-One question having addition, subtraction, multiplication and devide and ask to solve that	15 min	-Numerical changes in each interaction	-Money management

2. Control group Intervention: Cognitive Training

Sl. No	Domain	Contents of the activity	Duration
1	Memory training	1.Seven-piece board recovery training	9min
		2.Picture memory reading	9min
		3.Reading aloud	6min
		4.Reciting phrases	6min
2	Attention training	1.Colour training reaction	15min
		2.Schulte training Grid	15min
3	Calculation training	1.Two Simple Calculation question.	15min
		2. One simple application question for calculation (each interaction)	15min

DATA COLLECTION:

There are 113 subjects aged $\geqq$60 years in the baseline survey, and 102 subjects with MCI who participated in the baseline survey. A randomized control trial was conducted on 102(male=72 and female=30) patients with mild cognitive impairment (MCI) from Ashrams in Noida and shelter home in Ghaziabad. The total sample was randomly divided into two equal groups. Experimental group (N = 51) male=37, female=14 and a control group (N = 51) male=35, female=16. The control group was provided cognitive training, and the experimental group was administered graded cognitive training. Participants were distributed randomly in experimental and control group using chit method by assigning numbers two each participant. Researcher placed chits containing numbers allocated to each participant
and randomly selected chits for both groups. The intervention consisted of 90-minute sessions, conducted five days a week for four weeks, at ashrams. Researcher provided intervention along with presence of caregivers at participants places. The caregiver was given through training and orientation on intervention steps. Caregiver were also provided with detailed instruction script for providing intervention. Researcher provided intervention weekly basis as per intervention protocol. Immediately after the intervention period, participants underwent a post-assessment using the same measures as the pre-assessment to evaluate any changes or improvements.

DATA ANALYSIS:

After completion of all (pretreatment and post treatment) evaluation, results were collected and data were put in the master chart. The scoring of pre-treatment and post-treatment data of outcome measures MONTREAL COGNITIVE SCALE (MOCA), BRISTOL ACTIVITIES OF DAILY LIVING(BADL) AND WHO Quality of life (WHOQOL-Bref) were analyses using IBM SPSS for statistical significance result. This pre-test and post-test for scoring of experimental and control group were analyses through parametric test, T-test was used to analyses the cognition and activities of daily living scores for analysis of outcome measure. The collected data were analyzed using IBM SPSS Statistics, Trial Version. To describe about the data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in Paired groups the Test was used.

RESULT:

The result presented in two phases, pre-test and post-test assessment of both Control group and experimental group. The significance of Graded Cognitive Training was determined through MOCA, BADL and WHOQol-Bref administered to the participants before providing intervention. In second phase the post test assessment of MOCA, BADL and WHOQoL-Bref Re-administered after duration of 4 weeks, per week 5 sessions for 90 minutes was provided for intervention of experimental and control group.

Group Statistics

	Type	N	Mean	Std. Deviation	Std. Error Mean	P value
Age	Experiment	51	71.71	8.046	1.127	0.060
	Control	51	68.76	7.538	1.056	
MOCA Pre	Experiment	51	20.57	2.247	.315	0.654
	Control	51	20.39	1.674	.234	
MOCA Post	Experiment	51	25.59	2.109	.295	0.001
	Control	51	21.37	1.777	.249	
MOCA	Experiment	51	5.02	2.717	.380	0.001
	Control	51	.98	1.225	.171	
BADL Pre	Experiment	51	37.57	2.670	.374	0.900
	Control	51	38.53	2.996	.419	
BADL Post	Experiment	51	29.57	3.601	.504	0.001
	Control	51	37.73	2.736	.383	
BADL	Experiment	51	-8.00	3.335	.467	0.001
	Control	51	-.80	1.414	.198	
WHO QoL Pre	Experiment	51	47.59803922000004	4.461710742000000	.624764469000000	0.001
	Control	51	58.36601307000000	5.934739497000001	.831029752000000	
WHO QoL Post	Experiment	51	63.02287582000000	3.270069589000000	.457901332000000	0.001
	Control	51	49.44444444000000	6.239806502000000	.873747677000000	
WHO QoL	Experiment	51	15.42483660000000	5.097310154000001	.713766189000000	0.001
	Control	51	-8.921568627000001	4.363020480000000	.610945068000000	

Table 1. Descriptive statistics of outcome measure and T-Test statistics of Pre-test & Post-test of MOCA, BADL and WHO QOL-Bref in experimental group and control group.

Table 1. Showing the Descriptive Statistics of MOCA, BADL and WHO QOL-Bref in Pre- test and Post- test of experimental and control group and p- value that established statistical significance.

Here's a brief interpretation of the data:

The mean age of the Experiment group is 71.71 years, with a standard deviation of 8.046. The Control group has a slightly lower mean age of 68.76 years and a standard deviation of 7.538. The difference in mean age between the groups is not statistically significant ($p = 0.060$).

MOCA Pre: The Experiment and Control groups have similar baseline cognitive scores ($p = 0.654$).

MOCA Post: After the intervention, the Experiment group shows a significantly higher mean cognitive score (25.59) compared to the Control group (21.37) ($p = 0.001$).

Change in MOCA: The Experiment group shows a significant improvement in cognitive scores post-intervention compared to the Control group ($p = 0.001$).

BADL Pre: Both groups have similar scores in basic daily living activities at baseline ($p = 0.900$).

BADL Post: The Experiment group shows a significant decrease in basic daily living activity scores post-intervention (29.57) compared to the Control group (37.73) ($p = 0.001$).

Change in BADL: The Experiment group shows a significant decline in basic daily living activities post-intervention compared to the Control group ($p = 0.001$).

WHO QoL Pre: The Control group has a higher mean quality of life score at baseline (58.37) compared to the Experiment group (47.60) ($p = 0.001$).

WHO QoL Post: Post-intervention, the Experiment group shows a significantly higher mean quality of life score (63.02) compared to the Control group (49.44) ($p = 0.001$).

Change in WHO QoL: The Experiment group shows a significant improvement in quality-of- life post-intervention compared to the Control group ($p = 0.001$).

DISCUSSION:

The Present Study to Explore the Efficacy of Graded Cognitive Training Among Elderly Individuals with mild cognitive impairment.

In this study,102 participants were chosen from Apna Ghar Ashram Noida, Apni Sanskriti Charitable trust, Shelter home in and around Ghaziabad based on inclusion criteria. The subjects were divided into two groups, the control group and the experimental group. The administration of MOCA, BADL and WHO QoL- brief Scale to the participants for pre-test and post-test of control and experimental group. After collection of data pre-test and post-test of the data is analyzed and interpretation for statistical significance of intervention for control and experimental group.

Zhenren Peng et.al was Conduct a study on The Efficacy of Cognitive Training for Elderly Chinese Individuals with Mild Cognitive Impairment in 2019.The objectives of this research were to assess cognitive function in older adults using the Montreal Cognitive Assessment (MoCA), to determine the associations between various characteristics and cognitive function, and to assess the effectiveness of an intervention following a six-month period of cognitive training. Their result indicates that a deterioration in cognitive function is linked to getting older. Cognitive training considerably improves cognitive function, and the cognitive training intervention is beneficial and may help patients with MCI slow down the decline of their cognitive function.[7]

The current study examined the impact of intervention on graded cognitive function and among elderly individuals with mild cognitive impairment through pre-post analyses of MOCA, BADL and WHOQOL- Brief assessments.

In the experimental group, the descriptive statistics for pre-post analysis of MOCA, BADL and WHO QOL-Brief are presented, the mean pre-MOCA score is 20.57, suggesting mild cognitive impairments among participants, while the mean post-MOCA score increases to 25.59, indicating an improvement to a level of cognitive function.

In experimental group, the mean pre-BADL score is 37.57, implying a higher dependency on others for activities, whereas the mean post-BADL score fall to 29.57, signifying a reduction in dependency and progress toward independence.

In experimental group, the mean pre-WHOQOL-Brief score is 47.59, implying a quality of life., whereas the mean post-WHOQOL-Brief score raise to 63.02, signifying improves the quality of life.

The standard errors for pre-MOCA, pre-BADL and pre-WHOQOL-Brief are .315 ,0.374 and

.624, respectively, while for post-MOCA, post-BADL and post-WHOQOL-Brief are .295,.504 and.457 respectively. These values suggest a decrease in variability, indicating a more consistent improvement in cognitive function, independence and quality of life among participants in post-intervention.

Furthermore, the standard deviations for pre-MOCA, pre-BADL and pre-WHOQOL-Brief are 2.247,2.670 and 4.461 respectively, compared to 2.109,3.601 and 3.270 for post-MOCA, post- BADL, post-WHOQOL-Brief. This reduction in deviation underscores a more concentrated distribution of scores post-intervention, reflecting enhanced cognitive abilities, independence and quality of life levels among the elderly population.

In MOCA Pre test assessment, The Experiment and Control groups have similar baseline cognitive scores ($p = 0.654$) and in Post test assessment, After the intervention, the Experiment group shows a significantly higher mean cognitive score compared to the Control group ($p = 0.001$).

As Significant Change in MOCA are: The Experiment group shows a significant improvement in cognitive scores post-intervention compared to the Control group.

In BADL Pre test assessment, both groups have similar scores in basic daily living activities at baseline ($p = 0.900$) and in Post test assessment, the Experiment group shows a significant decrease in basic daily living activity scores post-intervention compared to the Control group ($p = 0.001$).

As significant Change in BADL are: The Experiment group shows a significant decline in basic daily living activities post-intervention compared to the Control group. Here decreases the analytic value increase the independency.

In WHO QoL- Bref Pre test assessment, The Control group has a higher mean quality of life score at baseline compared to the Experiment group ($p = 0.001$) and WHO QoL-Bref Post test assessment, the Experiment group shows a significantly higher mean quality of life score compared to the Control group ($p = 0.001$).

As significant Change in WHO QoL-Bref are: The Experiment group shows a significant improvement in quality-of-life post-intervention compared to the Control group ($p = 0.001$).

Consequently, the null hypothesis is rejected in favor of the alternative hypothesis, affirming the presence of

a significant improvement in cognitive impairment following the intervention and training regimen. Such statistical significance underscores the tangible benefits accrued by patients participating in the program, reinforcing the importance of GCT intervention strategies in managing cognitive decline.

Moreover, the observed enhancement in independence levels and quality of life among patients is a noteworthy outcome of the intervention. This finding not only underscores the efficacy of the intervention in addressing cognitive deficits but also highlights its broader impact on daily functioning and quality of life. These results contribute valuable insights to the existing body of literature on cognitive impairment management. They underscore the importance of GCT intervention approaches foster cognitive improvement, enhance functional independence and improves the quality of life. Additionally, investigating the specific components of the intervention that contribute most significantly to cognitive enhancement could inform the development of more GCT and effective interventions in the future.

CONCLUSION-

This study found that the graded cognitive activities is more significant than only basic cognitive activities for cognitive abilities in the adult with mild cognitive impairment. The activities help the adults with MCI to improve their quality of life and also decrease dependency.

LIMITATION OF STUDY-

The study may have a larger sample size, limiting its ability to draw broad conclusions or generalize findings to small populations, Population takes place from different places, could not study complications of chronic morbid conditions of elderly due to feasibility constraints, The gender ratios were not in same ratio.

FUTURE RECOMMENDATIONS-

The further study could be done by comprising more of ADL / Functional as well as recreational task, should provide adaptation training to the individuals so as to hearten them in addressing daily function and independence, The intervention program may be modifying for the application at Hospital set up, the outcome measure considering the cultural aspect may be considered, Further studies can be done with follow-up studies for more time, that would increase the power of the statistical analysis and also increase the generalizability of the result. Lastly, Further research could explore the long-term effects of such interventions and identify optimal strategies for sustaining cognitive gains over time

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