



# VIRTUAL REALITY-BASED MEDITATION INTERVENTION FOR MILD COGNITIVE IMPAIRMENT

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## ABSTRACT

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Mild cognitive impairment (MCI) is an intermediate stage of cognitive alteration, from usual ageing and dementia; the distinction between MCI and dementia is determined by the severity of cognitive decline leading to cognitive-Behavioural impairment. The number of patients with dementia is currently estimated at 47 million according to the World Health Organization, which is projected to reach 75 million by 2030. The economic cost of care for people suffering from Dementia has increased year by year. Due to the constant increase in the number of people with dementia, the economic burden of face-to-face interventions can longer be considered an economically optimized solution to the problem. This has led to the use of virtual reality as an intervention medium for addressing the problem of dementia, as a cost-effective and scalable solution. The present paper reports a feasibility study in which meditation protocol has been incorporated into the Virtual reality delivery system for subjects with Mild cognitive impairment. The With-in group analysis showed a significant difference (increase) in functions of Attention, Thinking operation, Spatial perception, Visual perception, and orientation in the Pre-Post condition and no significant difference between the method of delivery. This feasibility and effectiveness study provided preliminary results which indicate that Virtual reality-based meditation delivery can be utilized for subjects with MIC instead of a traditional meditation delivery system, for the scope of scalability and economic-optimization

**KEYWORDS:** Mild cognitive impairment; Virtual Reality; Meditation

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## INTRODUCTION

Mild cognitive impairment (MCI) is an intermediate stage of cognitive alteration, from usual ageing and dementia; the distinction

between MCI and dementia is determined by the severity of cognitive decline leading to cognitive-Behavioural impairment <sup>[1]</sup>. Dementia can be understood as a syndrome with a decline



in at least two of the five cognitive domains; memory, executive functioning, attention, visuospatial skills, and language [6]. Dementia is one of the foremost reasons for dependency among the elder population. The number of patients with dementia is currently estimated at 47 million according to the World Health Organization, which is projected to reach 75 million by 2030 [2]. The economic cost of care for people suffering from Dementia has increased year by year [3]. So as the population ages and there is a constant increase in population size, an increasing number of people will suffer from dementia [4]. Further people affected by mild cognitive impairment (MCI), a possible precursor to dementia will also increase significantly [5]. This will certainly put a tremendous load on the intervention and medical care programs. Although there are few pharmacological therapies available for people with dementia, the impact of these pharmacological interventions is quite limited with deeper downside associated with them e.g., many pharmacological interventions are fixated on sedation, which results in a decrease in autonomy for the individual suffering from Dementia [7]. This has shifted the emphasis from pharmacological interventions to non-pharmacological interventions, where the aim is to delay the decline of cognitive function in MCI [8]. These interventions range from direct cognitive therapy like mindfulness, music, etc. to assisted interventions e.g., through animals, etc., to focus on the improvement of attention [9,10]. Further due to the constant increase in the number of people with dementia, the economic burden of face-to-face interventions can longer be considered an economically optimized solution to the problem. This has led to the use of virtual reality as an intervention medium for addressing the problem of dementia, as a cost-effective and scalable solution. Many, modes of cognitive interventions have already been incorporated into a virtual reality medium. In this paper, we have conducted a study to demonstrate that meditation as an intervention strategy can also be integrated into a Virtual reality medium to address the problem of Mild cognitive impairment (MCI).

## MATERIALS AND METHODS

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## Participants

This double-blinded, randomized controlled study was conducted to map the cognitive functions of subjects with MCI after Meditation interventions with and without a VR medium. The inclusion criteria were: 1) age range 60 to 70 years (2) Verbal instruction execution and (3) MCI diagnosis. The exclusion criteria were: (1) Enrollment in the intervention program and (2) Diagnosis other than MCI which may impact cognitive-affective processing. Ninety-three subjects were accessed from eligibility and according to the inclusion and exclusion criteria. Fifty-eight subjects were allocated to the study. After randomization, subjects were allocated to either a meditation group (G1) or a meditation group with a virtual reality medium (G2). Five subjects from Group 1 and Four subjects from Group 2 were dropped from the program due to non-adherence to the frequency of the intervention or non-compliance with the protocol. The study was completed with forty-nine subjects, with Group 1 having twenty-four subjects and with Group 2 having twenty-five subjects.

## Measurement

Informed consent of participants was taken. The demographic information of participants was collected including age, sex, education, and marital status. The measurement tool employed was Loewenstein Occupational Therapy Cognitive Assessment-Geriatric (LOTCA-G) [11] and Mindfulness attention awareness scale [12]. LOTCA-G is an assessment tool for the older population, which evaluates eight cognitive areas: orientation, visual perception, spatial perception, motor praxis, visuomotor organization, thinking operation, memory, and attention/concentration. The LOTCA-G discriminates between healthy older adults and those with dementia and MCI and is sensitive to levels of dementia.

## Statistical analysis

Data analysis was done with SPSS statistical program. Kolmogorov–Smirnov test was used to determine the normality of data; the chi-square test was used for nominal data and Mann–the Whitney U test was used for between-group analysis. Lastly, the Wilcoxon signed-rank test was used for within-group Pre- to post-intervention analysis.

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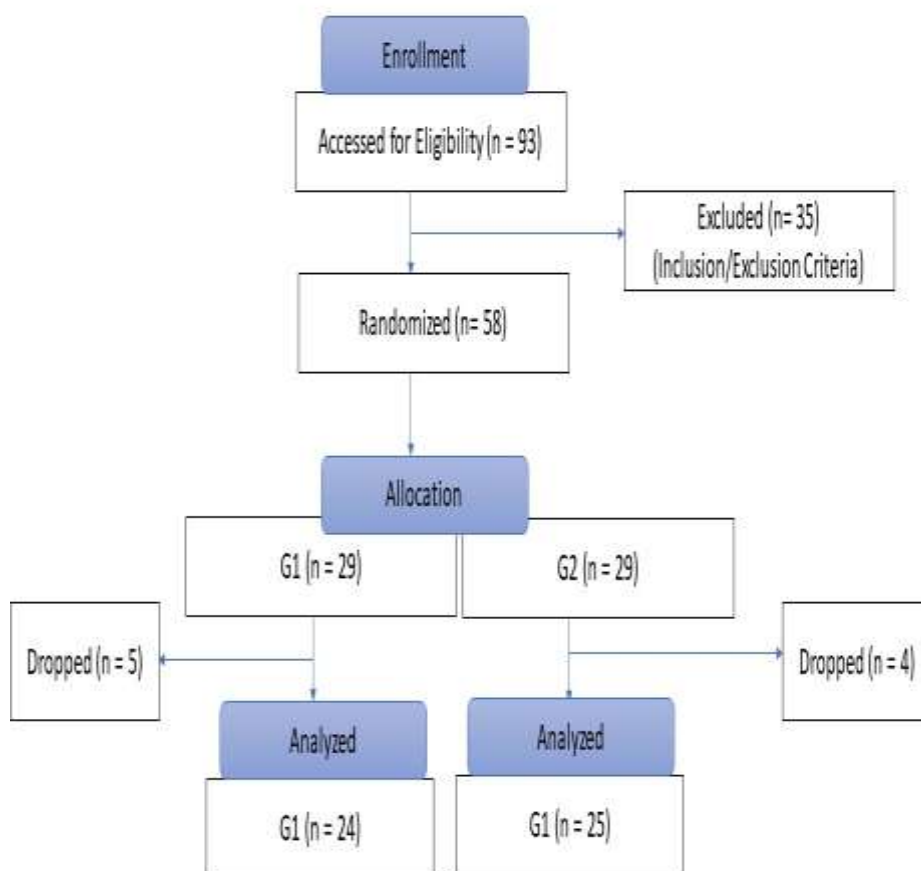


## RESULTS AND DISCUSSION

The demographic data are shown in Table 1. There was no significant difference between the group in terms of sex, age, and education level ( $P>0.05$ ), confirming the effectiveness of randomization. With-in group analysis showed an increase in mindfulness, validating the effectiveness of meditation intervention. With-in group analysis showed a significant difference

(increase) in functions of Attention, Thinking operation, Spatial perception, Visual perception, and orientation, and no significant difference for motor praxis, visuomotor, and memory cognitive abilities. There was no significant difference in between-group analysis for any of the cognitive functions, confirming our hypothesis that Virtual reality-based meditation delivery is as effective as a traditionally based meditation delivery system.

Figure 1



**Table 1**

Demographics	MG(n) (%/SD)		VRMG(n) (%/SD)	
Sex				
Male	18	75	20	80
Female	6	25	7	28
Age	64.30 (2.84)		64.13 (2.78)	
Education				
12 <sup>th</sup>	0	0	0	0
Bachelors	16	64	19	76
Masters	8	32	6	24
PhD	0	0	0	0

**Table 2**

Categories	MG Pre (Mean; SD)	MG Post (Mean; SD)	VRMG Pre (Mean; SD)	VRMG Post (Mean; SD)	MG P	VRMG P
Attention	2.65;0.38	3.55; 0.49	2.62;0.45	3.74;0.47	<0.05	<0.05
Orientation	14.05; 1.56	15.47; 2.09	14.23;1.45	15.78;1.78	<0.05	<0.05
Visual Perception	14.87; 1.01	15.23; 1.28	14.25;1.25	15.58;1.37	<0.05	<0.05
Spatial Perception	9; 1.12	10; 1.49	9.53;1.26	10.76;1.67	<0.05	<0.05
Thinking Operation	6.14; 1.07	6.75; 0.78	5.86;0.62	6.79;0.74	<0.05	<0.05
Memory	11.13; 1.09	11.23;1.59	10.98;0.36	11.05;0.67	0.8704	0.6345
Visuomotor	16.67;2.6	16.98;2.04	16.83;2.6	16.92;2.3	0.6412	0.8934
Motor Praxis	10.98;0.76	11.03;0.82	11.01;0.67	11.08;0.72	0.8240	0.7130



**Table 3**

Category	MGPre	MGPost	VRMGPre	VRMGPost	MGP	VRMGP
Mindfulness	3.58(0.91)	4.24(0.87)	3.53(0.89)	4.18(0.93)	<0.05	<0.05

**Table 4**

Items	Expert	Immediate	Basic	None
Experience with Computers	9.2%	68.4%	22.4%	-

**CONCLUSION**

As the With-in group analysis showed a significant difference (increase) in functions of Attention, thinking operation, Spatial perception, Visual perception, and orientation in the Pre-Post condition and no significant difference between the method of delivery, it can be inferred that the effectiveness of therapy delivery was not dependent upon the mode of delivery. Thus, this study provided preliminary results which indicate that Virtual reality-based meditation delivery can be utilized for subjects with MIC instead of a traditional meditation delivery system, for the scope of scalability and economic optimization. This study provided the grounding for conducting a fully longitudinal randomized trial for measuring the effectiveness of Virtual reality-based meditation with psychophysical measurement and neuroimaging assessment.

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