

# RELATION BETWEEN DEMENTIA IN OLDER ADULTS ON SPECIFIC TEST OF AUDITORY PROCESSING

*by* Asha Yathiraj

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**PROJECT PROPOSAL**

**Project Title:**

**RELATION BETWEEN DEMENTIA IN OLDER ADULTS ON SPECIFIC TEST OF AUDITORY PROCESSING** 11

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**Co-investigator: Dr. R. Sathianathan**

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## Part –A

**1.0. Title of the Project :** Relation between dementia in older adults on specific test of auditory processing

**Area of Research :** a) Speech, Language, Hearing

**1.1. Principal Investigator :** Prof. Asha Yathiraj, Professor of Audiology, AIISH, Mysuru

**2**  
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**1.2. Principal Co-Investigator(s) :** Prof. R. Sathianathen, Professor of Psychiatry & Senior Consultant, Sri Ramachandra University, Chennai

**1.4. Collaborating Institution :** Sri Ramachandra University, Chennai

**1.5. Total Grants Required :** ₹ 488000 (Four Lakh eighty eight thousand only)

**1.6. Duration of the Project :** 12 Months

## 2.0. Project Summary **5**

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It has been reported by Jerger, Stach, Pruitt, Harper, and Kirby (1989) and Jerger, Jerger, Oliver, and Pirozzolo (1989) that auditory processing abilities are affected in older individuals despite them having near normal hearing. One of the reasons noted for this reduced auditory processing abilities is the cognitive decline in these individuals (van Rooij & Plomp, 1990, 1991, 1992; van Rooij, Plomp, & Orlebeke, 1989). The current project aims to find a relationship between dementia in older adults and specific auditory processing abilities such as temporal processing, binaural integration, auditory separation / closure and auditory interaction. This will help in delineating the effect of dementia on auditory processing abilities in older adults. Older individuals above the age of 60 years categorized as having or not having dementia by a psychiatrist, will be administered tests of auditory processing by an audiologist. The presence of dementia will be confirmed by a psychiatrist using both behavioural and non-behavioural tests. The study will determine whether there exists a difference in quantum and severity of specific auditory processes in older individuals with and without dementia. The study will also provide information regarding the difference in auditory processes that are affected in individuals with 2

and without dementia. This will enable making recommendations for rehabilitation of auditory processes in older adults with dementia.

### **3.0. Introduction**

#### **3.1. Definition of the problem**

Dementia is defined as „deterioration of intellectual capacity that includes serious involvement in at least three of the following five areas: cognition, memory, language, visual-spatial skills and personality“ (Beck, Benson, Scheibel, Spar, & Rubenstein, 1982, p. 231). Auditory processing abilities have been reported to be affected in individuals with dementia (Gates, Anderson, Feeney, McCurry, & Larson, 2008; Gates, Anderson, McCurry, Feeney, & Larson, 2011; Krishnamurti, Snell, King, Drake, 2013; Strouse, Hall, & Burger, 1995).

#### **3.2. Objectives**

The objectives of the study are to compare the performance of older individuals with dementia on specific auditory processing abilities (temporal processing, binaural integration, auditory separation / closure and auditory interaction) with the performance of those without dementia.

#### **3.3. Review of status of research and development in the subject**

Research on auditory processing abilities in older individuals has gained considerable impetus in the recent past. These studies have focused on those without additional problems such as dementia. Research on auditory processing abilities on those with dementia is relatively sparse, especially in India.

#### **3.4. International and national status**

In one of the earliest studies assessing central auditory processing in individuals with Alzheimer's disease Strouse et al. (1995) reported that majority of the participants with Alzheimer disease failed on all the tests of central auditory processing. The tests that were administered included synthetic sentence identification with ipsilateral competing message (SSI-ICM), dichotic sentence identification (DSI), dichotic digits test (DDT), pitch pattern sequence (PPS), and the duration pattern test (DPT). They also reported increased asymmetry in the performance between the two ears. Among the tests administered, the performance of the group 3

with Alzheimer disease on dichotic digit test was reported to be poorer compared to the other tests. The performance on pitch pattern sequence was similar between the groups with and without Alzheimer disease. From the results they indicated a significant association between Alzheimer disease and central auditory processing disorder.

Gates et al. (2008) studied central auditory processing in individuals with memory loss but without the diagnosis of Alzheimer-type dementia. They assessed 313 older individuals aged between 71 to 99 years on tests of auditory processing including two dichotic tests and a monaural speech test with competing message. Additionally, test to assess cognitive functioning were also used. They reported that for groups with and without memory impairment, the scores were poorer compared to the control group. The differences in scores of the control and target groups were found to be largest for dichotic sentence identification test while largest difference in scores was reported on SSI-ICM for the groups with and without memory impairment. Based on the results of their study Gates et al. suggested that SSI-ICM when there was progression in the memory impairment to the diagnosis of Alzheimer dementia.

In a later study by Gates et al. (2011) evaluated if central auditory dysfunction was an early manifestation of Alzheimer dementia and testing for these could help in early identification of cognitive disorders. Using the similar methodology as in their earlier study (Gates et al., 2008) it was reported that moderate impairment on dichotic sentence identification test was associated with an increased risk of Alzheimer dementia. Moderate impairment on Dichotic digit test was also reported to be associated with increased risk. However they reported that when the scores were less than 50% this test was not a good predictor. Additionally, the SSI-ICM was also reported not to be a good predictor. Based on the results they concluded that severe central auditory dysfunction measured using dichotic sentence identification test was a strong predictor of Alzheimer dementia up to three years later.

Krishnamurti et al. (2013) assessed auditory processing abilities of monaural closure, monaural separation, binaural integration, and binaural separation in two groups of listeners. One groups consisted of individuals diagnosed with Alzheimer's disease and the other without. They found significant difference between the two groups on monaural closure abilities while a similar difference was not reported for the other skills. They also reported a significant reduction in the scores of the left ear of individuals with Alzheimer's disease on all the skills assessed. 4

From the review of literature it can be concluded that auditory processing abilities are affected in older individuals with dementia. The auditory processes that are reported to be affected include binaural integration and monaural closure. The studies reviewed were carried out overseas and there **1** a dearth of similar studies in Indian scenario.

### **3.5. Importance of the proposed project in the context of current status**

Studies reported in the liter<sup>8</sup> are indicate that central auditory dysfunction is often reported in older individuals with dementia (Gates et al., 2008; Gates et al., 2011; Krishnamurti et al., 2013; Strouse et al., 1995). However, most of these studies have evaluated individuals above the age of 70 years. There is a need to explore if older individuals less than the age of 70 years (60 to 70 years), diagnosed with dementia also report of similar changes in central auditory processing. It is also necessary to assess if there exists difference in auditory processing abilities in older adults without and with dementia.

Studies reported in literature have considered a limited number of central auditory processes. Hence, there is a need to study the effect of dementia on multiple auditory processes. This would provide information about the differential effect of dementia on different central auditory processes such as temporal processing, binaural integration, auditory separation / closure and auditory interaction. This information would help in providing deficit specific rehabilitation for older individuals with auditory processing deficits.

#### **Aim**

The current study aims to compare specific auditory processing abilities (temporal processing, binaural integration, auditory separation / closure and auditory interaction) of older individuals with dementia with those without dementia. 5

#### **4.0. Work Plan**

##### **4.1. Method**

The study will be carried out in a hospital setup where facilities for both audiological assessment of hearing and auditory processing abilities as well as psychiatric evaluation of dementia are available.

##### ***Participants***

Data will be collected from 50 older individuals above the age of 60 years. The older individuals will be divided into two groups with 25 individuals in each group. One group will consist of older adults with a diagnosis of dementia and the other group without any memory difficulties/impairments. Only those with normal middle ear function will be included, as determined using immittance evaluation. Participants without any reports of otological, speech and language problems will only be considered. All the participants should have studied English from high school onwards.

##### ***Equipments***

- A calibrated dual channel audiometer with facility for routing recorded audio signals for assessing hearing thresholds and administering tests of auditory processing,
  
- A calibrated middle ear analyser for assessing middle ear functioning.

##### ***Test materials***

- Screening checklist for auditory processing in Adults, SCAP-A (Vaidyanath & Yathiraj, 2014)
  
- Gap-In-Noise test (Musiek et al., 2005) to assess temporal resolution abilities
  
- Dichotic digit test (Shivashankar & Herlekar, 1991) / Dichotic CV test (Yathiraj, 1999) to assess binaural integration abilities.
  
- Speech-in-noise test in Indian English (Yathiraj, Vanaja, & Muthuselvi, 2010) to assess auditory separation / closure

□ Test to assess cognitive status/ dementia including Mini Mental state examination, Rowland Universal Dementia assessment scale, Montreal cognitive Assessment, Frontal Assessment Battery.

### **Procedure 3**

*Pure-tone air conduction and bone conduction thresholds* will be obtained using the modified Hughson-Westlake procedure (Carhart & Jerger, 1959). Air conduction thresholds will be established for frequencies between 250 to 8000 Hz at octave intervals. Bone conduction thresholds will be established for frequencies of 250 to 4000 Hz at octave intervals.

*Middle ear function* will be assessed using a calibrated immittance meter. Tympanogram will be obtained with a 226 Hz probe tone. Ipsilateral and contralateral reflex thresholds will be established for frequencies of 500, 1000, 2000 and 4000 Hz.

*Gap-In noise test* will be used to assess the temporal resolution abilities. The CD version of the test will be presented at 50 dB SL (re: PTA). Each ear will be evaluated separately under headphones. The minimum gap duration which is identified minimum 4 times out of the 6 presentations will be considered as the gap detection threshold.

*Dichotic Digit test / Dichotic CV test* will be used to assess binaural integration abilities. The CD version of the test will be presented at 40 dB SL (re: PTA) using a headphone. Single correct score for the two ears and the double correct scores will be obtained.

*Speech-in-noise test in Indian English (SPIN-IE)* will be administered at 40 dB SL (re: SRT) to assess auditory separation / closure abilities. Each ear will be assessed separately under headphones. The test consists of monosyllabic words in English presented at 0 dB signal-to-noise ratio. Each correct response will be given a score of 1 and every incorrect response a score of 0.

*MLD or Filtered Speech test* will be administered to assess auditory interaction. The test will be done under headphones with the signals being routed through a two channel audiometer. A narrow-band noise centered around 500 Hz will be presented binaurally at 40 dB SL.

*Tests to assess dementia:* To diagnose individuals with dementia, both behavioural and non-behavioural evaluations will be carried out by a psychiatrist. The behavioural assessment will include the administration of Mini Mental state examination (Folstein, Folstein, & McHugh, 7



1975), Rowland Universal Dementia assessment scale (Storey, Rowland, Conforti, & Dickson, 2004), Montreal cognitive Assessment (Nasreddine et al., 2005), and Frontal Assessment Battery (Dubois, Slachevsky, Litvan, & Pillon, 2000). In addition to these radiological information (CT/MRI) will also be used to ascertain the diagnosis of dementia.

*Analyses*

Data obtained from the two groups of older individuals will be tabulated and the data will be analysed using SPSS 18 software. Descriptive and analytical statistics will be obtained. Descriptive statistics will include mean and standard deviations. Appropriate inferential statistics will be obtained.

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Pierre L. Divenyi. "Audiological Correlates of Speech Understanding Deficits in Elderly Listeners with Mild-to-Moderate Hearing Loss. I. Age and Lateral Asymmetry Effects", Ear & Hearing, 02/1997

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