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READING AND COMPREHENSION INTERRUPTION IN BILINGUAL ALZHEIMER'S DISEASE PATIENTS

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Abstract:
Alzheimer's disease (AD) is characterized by a decline in a person's ability to think, to remember, to communicate that is severe enough to affect daily activities. For this study, thirty Kashmiri Bilingual AD (Mild-Moderate-Severe) patients and an equal number of controls matched for age, gender and education were tested in a reading comprehension Task. The study aimed to find out the effect of Alzheimer's disease on the patient's ability to comprehend information in reading comprehension and whether the subjects are able to read and respond properly. The results from the Cross-sectional Comparison in this study reveal that Mild and Moderate AD patients produce more errors in reading, comprehension and translating sentences than Control group. While as Advanced AD patients show a severe impairment in their ability to read and comprehend.

Key Words: Alzheimer's Disease (AD), Comprehension Task, Cross-Sectional Comparison, Kashmiri & Reading

1. Introduction:

Dementia is an observable decline in mental abilities. It is an acquired clinical syndrome characterized by deterioration of mental functioning in its cognitive (ability to process thought), emotional and conative aspects. [1]. In dementia, recently learned information also known as episodic memory is retained the least while as, the older and more remote information (retrospective information) is often moderately preserved. In dementia, a retreat to the original language could result from the cross-language difficulties that typically increase with age. "Cross-language interference" refers to deviations from the language being spoken due to the involuntary influence of the "deactivated" language. Bilingual people never totally deactivate either of their two languages, and that can result in interference or interruptions, mainly from the dominant language into the other one. Patients with dementia tend to mix languages, and they have specific problems with language separation [2]. Classically, linguistic changes in DAT have been ascribed to the involvement of the left-temporo-parieto-occipital junction area [3]. However, in the initial stages of the disease, the neuropathological process affects the medial temporal lobe, especially the entorhinal cortex and the hippocampus [4] [9] [10]. Women are more prone to Alzheimer's disease as compared to men because of many hormonal variations. Short-term verbal memory studies in humans indicate that estrogens have positive effects in women in whom estrogen levels have been reduced by various means [5] [11] [12] Estrogen elevation in women has also been associated with better performance of fine motor skills and poorer performance on tests of spatial recognition [6] [7].

2. Objectives:

This paper will attempt to look at the effect of Alzheimer's disease on the Reading/Comprehension of AD patient's in Kashmiri (L1) and Urdu language (L2).

3. Pathology:

At autopsy, the earliest and most severe degeneration is usually found in the medial temporal lobe (entorhinal/perirhinal cortex and hippocampus), lateral temporal cortex, and nucleus basalis of Meynert. The characteristic microscopic findings are neuritic plaques and NFTs. These lesions accumulate in small numbers during normal brain aging but dominate the picture in AD.

4. Methodology:

A random sample of thirty cases of clinically diagnosed Alzheimer's disease patients and thirty normal people as control group are considered for the present study. The data were collected from Shri Maharaja Hari Singh Hospital, and some of them were met personally at their home. The subjects were in the age group 60 to above 90 years. These thirty subjects, upon whom tests were administered, were considered for further study. This paper deals with the analysis of the thirty Male subjects, who suffered neuro-degeneration to the different parts of the brain and were able to respond to the tests, along with the thirty subjects as normal control group. On the basis of the medical reports, all subjects under study are categorized into three groups: Mild AD, Moderate AD, and Advanced AD. Out of thirty cases, 12 cases were Mild AD cases, 10 were AD Moderate and 8 were Advanced AD patients.

5. Test Batteries for Language Deficit:

Since the present study is focused on Linguistic Profiling of Alzheimer's disease rather than Dementia, it was decided to perform a simple Kashmiri and Urdu bilingual Test with focus on language deficit in production, comprehension, picture naming and picture recognition abilities in Kashmiri and Urdu language. A Reading/Comprehension test includes a given passage and a set of 5 questions which AD patients have to read/comprehend and answer respectively in both Kashmiri and Urdu language. This test allows us to understand whether the AD patients can read and comprehend the given passage completely or not and whether they are able to answer the questions or not. 5 marks are allotted for reading and 2 marks are allotted to each correct response.

6. Reading Comprehension Test:

From the bar chart presented above the following tentative conclusions can be drawn-

- ✓ Mild AD subjects show better performance than the other two groups (Moderate Alzheimer's disease and Advanced Alzheimer's disease) in both Kashmiri and Urdu Reading/Comprehension test while comparing with Normal Control group.
- ✓ As compared with the control group, Mild AD group shows a deficit of 33.6% and 38% in Kashmiri and Urdu Reading/ Comprehension test respectively. Moreover, Mild AD subjects show better performance in Urdu Reading/

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Comprehension test (60%) as compared to Kashmiri Reading/Comprehension test (51%) with a minimum deficit of 9%. This was due to the reason that the subjects were more comfortable in Urdu reading than Kashmiri.

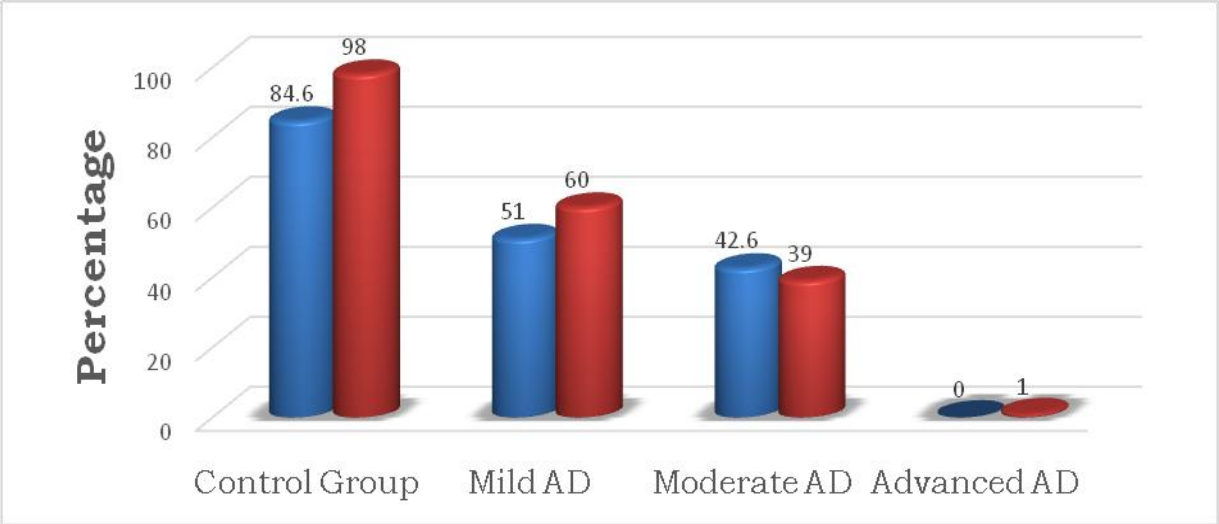

Figure 1: Percent Scores showing Reading and comprehension difficulty among Mild, Moderate and Advanced Male AD Patients.

- ✓ As compared with the Mild AD group, Moderate AD group shows a deficit of 8.4% in Kashmiri Reading/ Comprehension test and 21% in Urdu Reading/Comprehension test and around 42% and 59% in Kashmiri Reading/ Comprehension test and Urdu Reading/Comprehension test respectively while comparing with the performance of Normal Control Group.
- ✓ As compared to Normal Control Group, Advanced AD group shows maximum deficit of 84.6% in Kashmiri Reading/ Comprehension test and almost 97% in Urdu Reading/Comprehension test. The scores generally corresponds to the severity of cases. The reason behind the maximum deficit is that advanced group was not able to read at all.

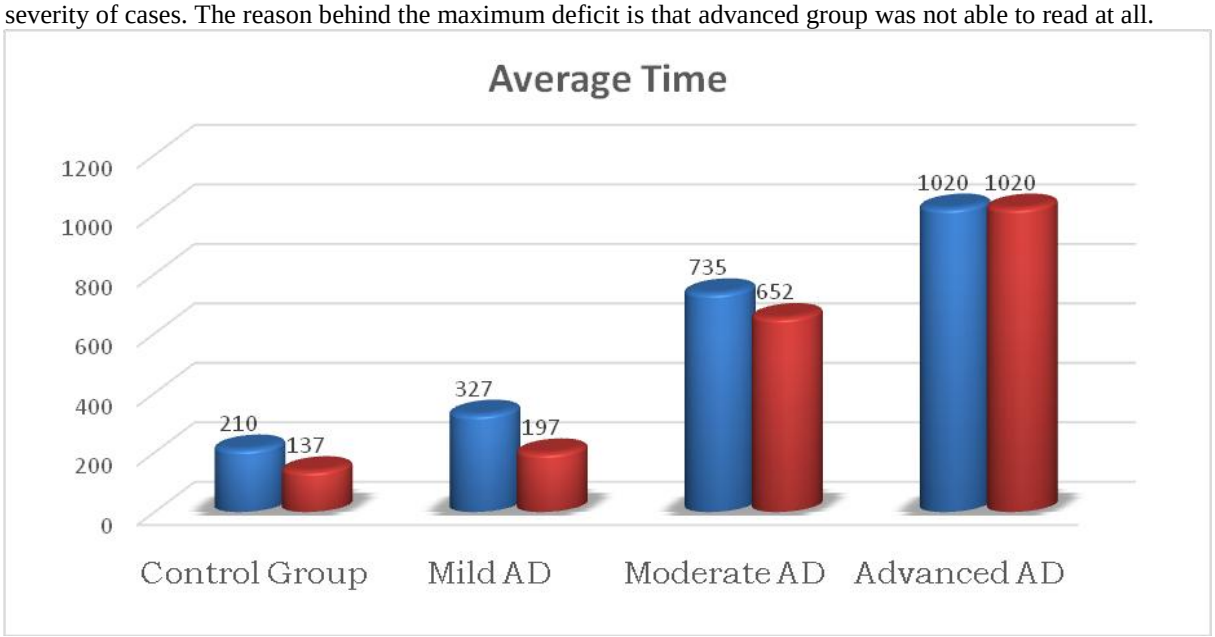

Figure 2: Average Time taken by Mild, Moderate and Advanced Male AD Patients in case of Reading and comprehension Test

From the bar chart presented above the following tentative conclusions can be drawn-

- ✓ The span of the time increases as we move from Control group to Advanced AD subjects. The time taken by the control group in Urdu Reading/Comprehension is less (137 secs) as compared to Kashmiri Reading/Comprehension test (210 secs).
- ✓ The time taken by the Mild AD, Moderate AD and Advanced AD subjects in Kashmiri Reading/Comprehension test is 327, 735 and 1020 seconds respectively and time taken for the completion of Urdu Reading/Comprehension test is 137, 197 and 1020 seconds respectively. The time taken generally corresponds to the severity of cases. Lesser the severity lesser is the time taken and more the severity more is the time taken.

7. Bar Representation of Reading and Comprehension Test Results of Male Ad Subjects:

7.1 Reading Comprehension Test:

From the bar chart presented above the following tentative conclusions can be drawn-

- ✓ Mild AD subjects show better performance than the other two groups (Moderate Alzheimer's disease and Advanced Alzheimer's disease) in both Kashmiri and Urdu Reading/Comprehension test while comparing with Normal Control group.

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- ✓ As compared with the control group, Mild AD group shows a deficit of 33.6% and 38% in Kashmiri and Urdu Reading/ Comprehension test respectively. Moreover, Mild AD subjects show better performance in Urdu Reading/ Comprehension test (60%) as compared to Kashmiri Reading/Comprehension test (51%) with a minimum deficit of 9%. This was due to the reason that the subjects were more comfortable in Urdu reading than Kashmiri.

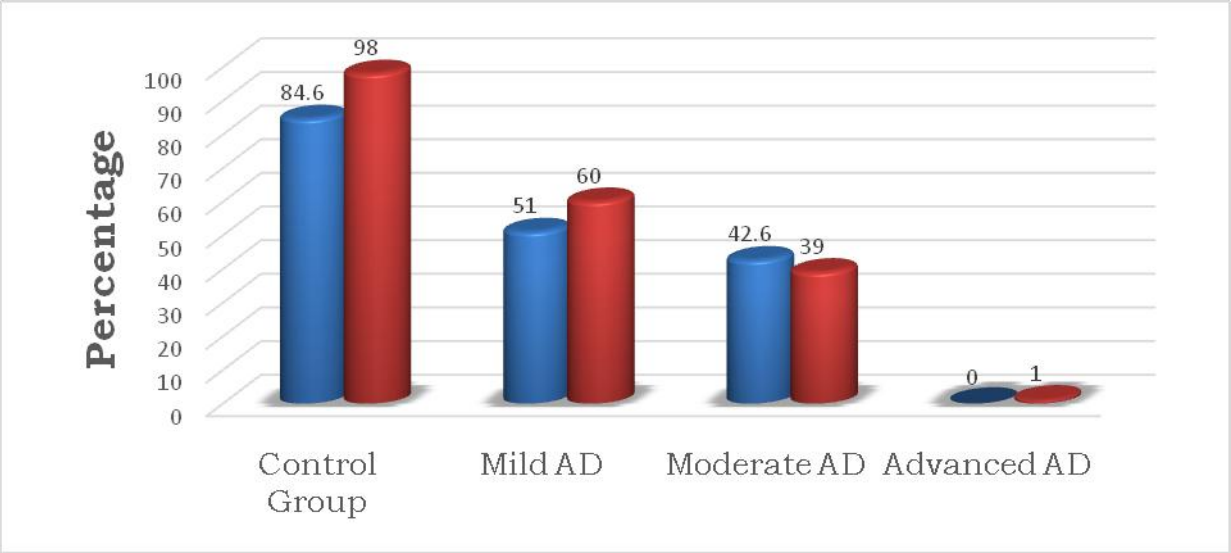

Figure 3: Percent Scores showing Reading and comprehension difficulty among Mild, Moderate and Advanced Male AD Patients

- ✓ As compared with the Mild AD group, Moderate AD group shows a deficit of 8.4% in Kashmiri Reading/ Comprehension test and 21% in Urdu Reading/Comprehension test and around 42% and 59% in Kashmiri Reading/ Comprehension test and Urdu Reading/Comprehension test respectively while comparing with the performance of Normal Control Group.
- ✓ As compared to Normal Control Group, Advanced AD group shows maximum deficit of 84.6% in Kashmiri Reading/ Comprehension test and almost 97% in Urdu Reading/Comprehension test. The scores generally correspond to the severity of cases. The reason behind the maximum deficit is that advanced group was not able to read at all.

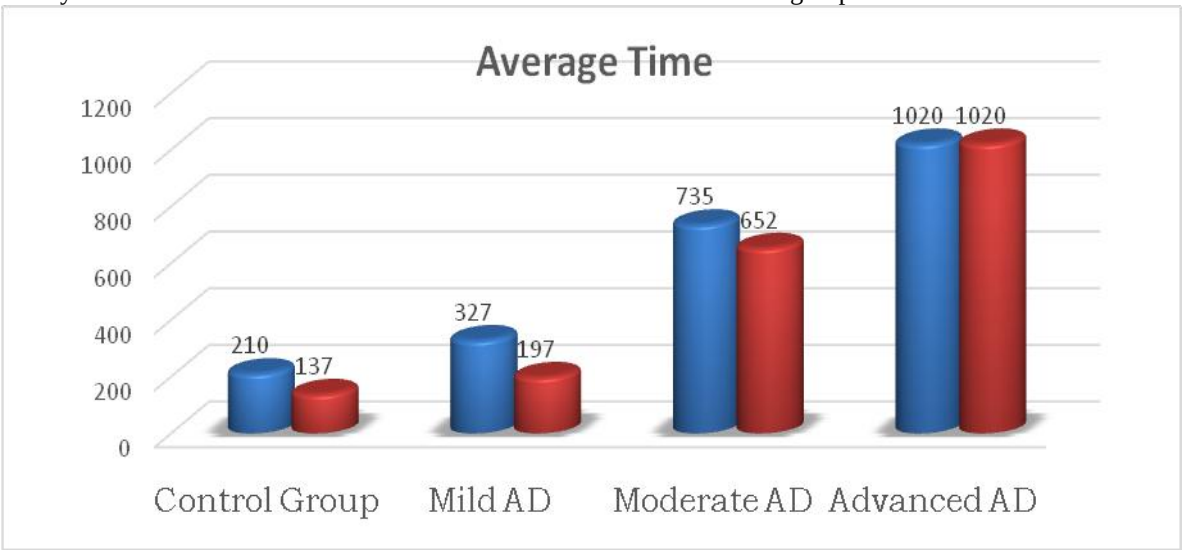

Figure 4: Average Time taken by Mild, Moderate and Advanced Male AD Patients in case of Reading and comprehension Test

From the bar chart presented above the following tentative conclusions can be drawn-

- ✓ The span of the time increases as we move from Control group to Advanced AD subjects. The time taken by the control group in Urdu Reading/Comprehension is less (137 secs) as compared to Kashmiri Reading/Comprehension test (210 secs).
- ✓ The time taken by the Mild AD, Moderate AD and Advanced AD subjects in Kashmiri Reading/Comprehension test is 327, 735 and 1020 seconds respectively and time taken for the completion of Urdu Reading/Comprehension test is 137, 197 and 1020 seconds respectively. The time taken generally corresponds to the severity of cases. Lesser the severity lesser is the time taken and more the severity more is the time taken.

8. Statistical Procedure:

Out of various softwares available for the statistical analysis, SPSS (Statistical software for social sciences) is used for the statistical analysis of data. For the data analysis in present study, SPSS used. The statistical technique namely Distance Correlation is used to determine the association between the variables in the form of distances, more the distance far the variables are from each other and vice versa.

8.1 Discussion on Distance Correlation Results: The distance correlation displays Bar graphs based on Case summaries and Proximity matrix of Spatial Relation Test:

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- ✓ The SPSS Output For Distance Correlation among Male Mild, Moderate and Advanced Ad Groups and Discussion on Correlation Results
- ✓ Proximity matrix and Case Summaries showing Distance Correlation in Case of Kashmiri Reading Comprehension Test

Table 1: Case Summaries

	Control Group	Mild AD	Moderate AD	Advanced AD
Mean	12.7333	7.6667	6.4	0.4
Std. Deviation	2.25093	0.8756	1.51658	0.54772
Time	210	327	735	1020

Table 1 indicates that the average score taken by a Control Group in Kashmiri Reading and comprehension test is 12.7 while as score taken by the Subjects in Mild, Moderate and Advanced Stage are 7.6, 6.4 and 0.4 respectively, also the time taken by a Control Group person in this test is 210 seconds while as time taken by Subjects in Mild, Moderate and Advanced Stages are 327, 735 and 1020 seconds respectively.

Table 2: Proximity Matrix

	Euclidean Distance			
	Control Group	Mild AD	Moderate AD	Advanced AD
Control Group	0	14.671	17.916	30.903
Mild AD	14.671	0	5.315	16.378
Moderate AD	17.916	5.315	0	14
Advanced AD	30.903	16.378	14	0

Table 2 is called a Proximity matrix/Distance Matrix/ Dissimilarity Matrix which is used to predict the differences in the variables, more value between the variables corresponds to the severity of the case. Whereas, 0 value indicates that variable are same.

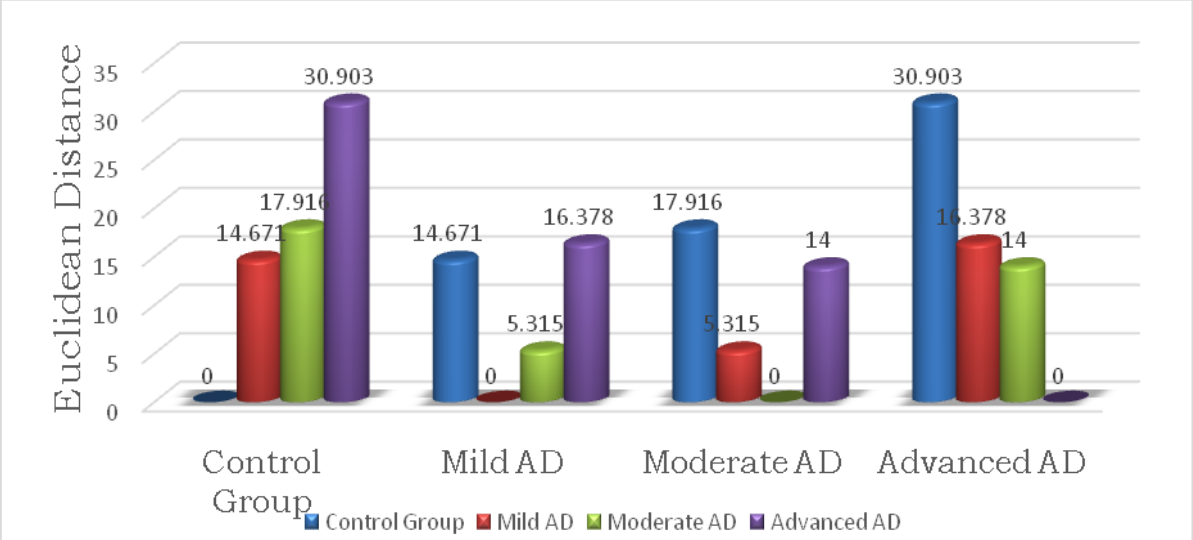

Figure 5: Euclidean distance showing difference between Mild, Moderate and Advanced Male AD Patients in case of Kashmiri Reading/ Comprehension Test.

From the table and the bar chart given above, the following conclusions can be drawn:

- ✓ As compared to the Control Group, the Mild AD and Moderate AD subjects have better performance. The performance of Mild AD and Moderate AD subjects are almost similar with a minimum Euclidean distance of 3.2 between them in Kashmiri Reading and Comprehension test. Hence, the Mild AD subjects have satisfactory control over Kashmiri Reading and comprehension.
- ✓ However, in case of Advanced AD subjects there is a drastic fall of result which leads to abrupt increase in Euclidean distance. It is also clear that the Mild AD and Moderate AD subjects have some knowledge of Reading and Comprehension but Advanced AD subjects have severely affected Reading and comprehension.
- ✓ As compared to Control Group, the Euclidean distance shows increase from Mild AD to Moderate AD and from Moderate AD to Advanced AD subjects. The Euclidean distance between Control Group and Mild AD subjects is 5.8 whereas, the Euclidean distance between Control Group -Moderate AD subjects and Control Group-Advanced AD subjects is 29 and 43 respectively. The Euclidean distance is least for Mild AD subjects and greater for Advanced subjects.
- ✓ As compared to Mild AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Mild AD -Advanced AD subjects is 24 and 37.9 respectively.
- ✓ As compared to Moderate AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Moderate AD -Advanced AD subjects is 24 and 14 respectively.
- ✓ As compared to Advanced AD subjects, the Euclidean distance between Mild AD-Advanced AD subjects and Moderate AD -Advanced AD subjects is 37.9 and 14 respectively.

8.2 Proximity matrix and Case Summaries showing Distance Correlation in Case of Urdu Reading Comprehension Test:

Table 3: Case Summaries

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	Control Group	Mild AD	Moderate AD	Advanced AD
Mean	14.4667	12	5.9	0.2
Std. Deviation	1.0601	1.41421	2.30217	0.44721
Time	143	200	633	1020

Table 4.28 indicates that the average score taken by a Control Group in Urdu Reading and comprehension test is 14.4 while as score taken by the Subjects in Mild, Moderate and Advanced Stage are 12, 5.9 and 0.2 respectively, also the time taken by a Control Group person in this test is 143 seconds while as time taken by Subjects in Mild, Moderate and Advanced Stages are 200, 633 and 1020 seconds respectively.

Table 4: Proximity Matrix

	Euclidean Distance			
	Control Group	Mild AD	Moderate AD	Advanced AD
Control Group	0	6.557	20.451	32.665
Mild AD	6.557	0	15.564	26.944
Moderate AD	20.451	15.564	0	13.537
Advanced AD	32.665	26.944	13.537	0

Table 4 is called a Proximity matrix/Distance Matrix/ Dissimilarity Matrix which is used to predict the differences in the variables, more value between the variables corresponds to the severity of the case. Whereas, 0 value indicates that variable are same.

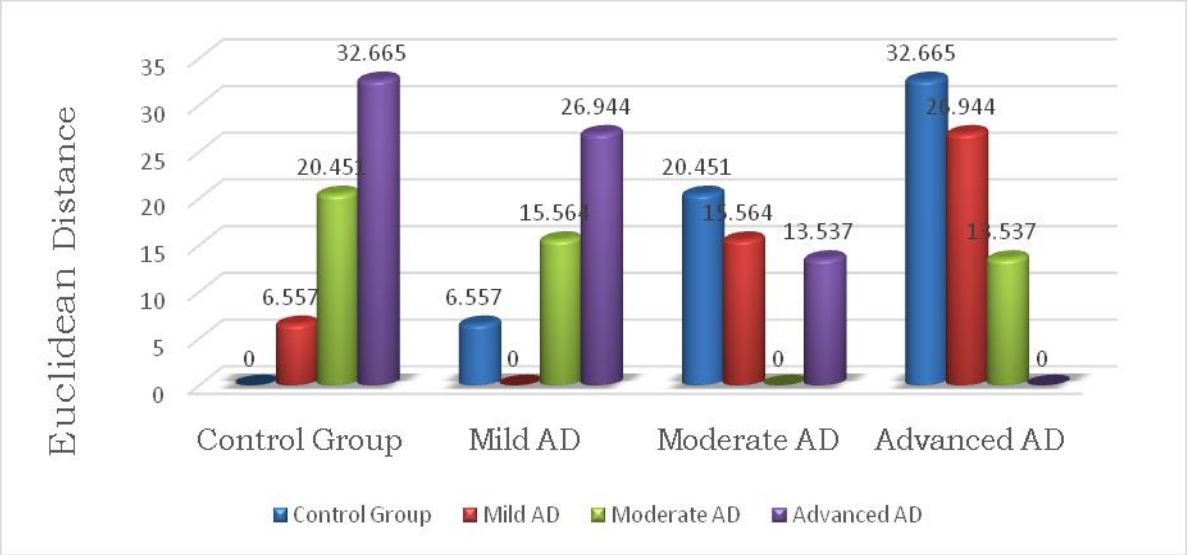

Figure 6: Euclidean distance showing difference between Mild, Moderate and Advanced Male AD Patients in case of Urdu Reading/ Comprehension Test.

From the table and the bar chart given above, the following conclusions can be drawn:

- ✓ As compared to the Control Group, the Mild AD subjects have better performance than Moderate AD and Advanced AD subjects. Hence, the Mild AD subjects have satisfactory control over Urdu Reading and comprehension.
- ✓ However, in case of Moderate AD and Advanced AD subjects there is a drastic fall of result which leads to abrupt increase in Euclidean distance. It is also clear that the Mild AD have well-kept knowledge of Reading and Comprehension but Moderate AD and Advanced AD subjects have severely affected Urdu Reading and comprehension.
- ✓ As compared to Control Group, the Euclidean distance shows increase from Mild AD to Moderate AD and from Moderate AD to Advanced AD subjects. The Euclidean distance between Control Group and Mild AD subjects is 6.5 whereas, the Euclidean distance between Control Group -Moderate AD subjects and Control Group-Advanced AD subjects is 20.4 and 32.6 respectively. The Euclidean distance is least for Mild AD subjects and greater for Advanced subjects.
- ✓ As compared to Mild AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Mild AD - Advanced AD subjects is 15.5 and 26.9 respectively.
- ✓ As compared to Moderate AD subjects, the Euclidean distance between Mild AD-Moderate AD subjects and Moderate AD -Advanced AD subjects is 15.5 and 13.5 respectively.
- ✓ As compared to Advanced AD subjects, the Euclidean distance between Mild AD-Advanced AD subjects and Moderate AD -Advanced AD subjects is 26.9 and 13.5 respectively.

9. Conclusion:

Reading comprehension is affected early in Alzheimer's disease and progresses gradually from Mild to Advanced stage. However, examining patients at different stages of disease predicted that reading comprehension is relatively stable in Mild AD patients. Whereas, patients with Moderate AD have much impairment as compared to Mild AD and Advanced AD showed almost complete loss of Reading Comprehension ability due to the severity of disease. This disorder is the result of Coherence breakdown. It was seen that conversational speech in Kashmiri was better than Urdu. However, the following were observed: loss of attention, diversion, word retrieval deficits, perseveration with decreased internal coherence. Shouting, sudden code switching,

mutism, and inappropriate laughter are late-appearing features. It was also observed that Male AD patients have better control over Urdu Reading/Comprehension as compared to Kashmiri Reading/ Comprehension in AD Patients at Mild stage.

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