Original Article

The study of lexical relations device in speech of elderly Alzheimer patients and non-patients

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Abstract

Introduction: Verbal cohesion is one of the comprehension factors that can be affected by Alzheimer. Lexical relations device is also one of cohesive devices. Despite substantial researches in the field of neurological diseases and cohesive devices, there has been no analysis and comparison of lexical relations as a subset of cohesive devices in the speech of elderly Alzheimer patients and non-patients yet. Therefore, it seems necessary to perform such studies. Besides, the study of possible disorders in the speech of elderly Alzheimer patients is a step toward a more accurate illustration of brain and language relation and may contribute to verbal rehabilitation of these patients as well. The purpose of this research was to study and compare the application of lexical relations device in the speech of elderly Alzheimer patients and non-patients based on Dooley and Levinson's (2001) perspective.

Materials and Methods: The participants of this research were 6 elderly Alzheimer and 6 elderly non-patients who lived in nursing homes of Birjand and Qaen. The linguistic data was gathered during 5 months (22 September 2012 to18 February 2013). The age range of the subjects was 74 to 90 years old, who were all women with severe Alzheimer. A 40 minute speech sample of each subject was recorded. The data was analyzed using SPSS software version 20 and independent t test.

Results: The results of t-test analysis indicated that there was a significant difference between the application of lexical relations device in the speech of non-patients and elderly Alzheimer patients ($P=0.009$). In fact, based on individual results of all kinds of lexical relations, it was observed that, except for collocation device ($P=0.107$), there was a significant difference in the other two subsets: part-whole ($P=0.019$) and hyponymy ($P=0.044$).

Conclusion: It seems that there was a significant difference between the application of lexical relations device in the speech of non-patients and elderly Alzheimer patients.

Keywords: Alzheimer, Elderly, Speech

Introduction

Neurolinguistics which deals with the relation between the brain and language is a suitable platform to study linguistic disorders. According to Franca, neurolinguistics is a branch of cognitive neuroscience that, in its turn, is a branch of a higher field called neuroscience (1).

The history of scientific and clinical investigations of the brain concerning linguistic functions dates back to a long time in the past. Franca stating that: "The emphasis on linguistic lesions dates back to

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400 years before Christ" (2).

Dementia is one of the most common neurological diseases and one of the most important health threatening factors in senior adults that is completely diagnosable only after the patient's death and only through samplings. Alzheimer's disease, due to its high prevalence and destructive nature, is probably the most important neurodegenerative disease (3).

According to Harrison, Alvish Alzheimer first explained the clinical and pathologic features of this disease on a 55-year-old deceased senior woman in 1907. Since then, the phrase "Alzheimer's disease" has been used in the case of any prevenient dementia occurring at the late stages of seniority (4). However, "this disease, like other dementia cases, starts very slowly, and, in the course of one to three months,

leads to dementia along with insensitivity and inability resulting in motion disorders and ultimately brings about the destruction of the body and eventually death" (5).

In addition, Kaplan classifies Alzheimer's disease into two categories: early and late Alzheimer. Consequently, Alzheimer is a progressive disease which mostly appears after years of Aphasia and Agnosia and eventually causes walking disorders and crippling state. On the other hand, in this disease, the brain cells are destroyed and the relation between them becomes disordered resulting in the gradual destruction of the memory and other intelligence functions (6).

From an epidemiology standpoint, Aminoff believes that 50 to 60 percent of patients with dementia are also suffering from Alzheimer's disease. According to his viewpoint, Alzheimer disease is more common in women. On the other hand, the cause of Alzheimer disease is yet unknown (3). However, "the existence of slow viruses, genetic readiness, aluminum intolerance level and failure of the body immune system probably has effects on its cause" (5).

Besides, as Kafman states, brain activity at the posterior region that is very critical for speaking and memorizing is reduced in Alzheimer disease. These prevenient linguistic and speech disorders gradually worsen through the time (7).

Therefore, Kaplan claims that patients suffering from Alzheimer's dementia have problems in speaking and comprehension that can be observed in their vague, cliché, inaccurate and dodging manner of speech (6). According to Kafman, one of the tests for identifying and determining Alzheimer disease in patients is the MMSA test. This test was invented in 1970 by Marshal Folsteine for the purpose of dementia screening.

Furthermore, the Alzheimer disease has numerous clinical features. Based on Aminoff, memory disorders are usually the first signs of Alzheimer disease usually first recognized by family members. As the memory disorder progresses, the patient loses awareness of time and proximity, and later, s/he loses spatial awareness. Aphasia, naming disorder, and calculation disorders may also occur during Alzheimer disease (3).

Several English studies have been carried out investigating linguistic disorders in patients suffering from Alzheimer disease, among which the following two researches are referred to:

According to Grossmans studies, Alzheimer patients have serious disorders in comprehending names and activities (8).

Furthermore, Ripich states in his study that patients suffering from Alzheimer disease do not appropriately apply cohesion and coherence in their speech and suffer from disorders (9).

There have also been a limited number of researches in Persian about linguistic disorders of Alzheimer's disease. Mehri and Alami, after examining the naming ability in patients suffering from Alzheimer's disease pointed out that it has serious damages on the semantic system of these patients (10). Khoddam also studied the following linguistic features: naming, comprehension, lexical richness and speech rate in senior Alzheimer patients (11).

On the other hand, cohesion is one of the most important concepts of discourse analysis that refers to semantic relations in text. Cohesion is perhaps affected by Alzheimer. Based on Dooley and Levinsohn (2001), each language has its own way(s) to show discourse cohesion. Of course, some of these cohesion devices are the same among different languages (12). As to cohesion, Taki (2000) also claims that there are some factors involved in a text structure that are different from factors making individual sentences. Cohesion is one of these factors (13). Following Dooley and Levinson (2001), cohesion devices present how the part of the text with which they occur links up conceptually with some other part.

Also, discourse analysts believe that there are formal elements named cohesion devices between sentences and inner space of the text that play the role of giving rise to cohesion and semantic relations of text sentences and help readers comprehend and interpret the text and satisfactorily understand its purpose (14). Dooley and Levinsohn introduce the cohesion devices as shown in the Table 1.

Table 1. Types of cohesive devices

1-Descriptive expressions alluding to entities mentioned earlier	
2-Identity	a) repetition (whole or partial), b) lexical replacement, c) pronouns, d) other pro-forms, e) substitution, f) ellipsis
3-Lexical relations	a) hyponymy (type of) b) part-whole c) collocation
4-Morphosyntactic patterns	a) consistency of inflectional categories (tense, aspect, etc.) b) echoic utterances c) discourse-pragmatic structuring

5-Signals of relations
between propositions

6-Intonation patterns

In this regard, lexical relations device is one of cohesion devices that consist of collocation, hyponymy and part-whole metaphor. This research is going to investigate types of lexical relations and their application in the speech of non-patients and elderly with Alzheimer. In this research we are going to study the speech of elderly with Alzheimer and non-patients ones in order to be primer of such studies in Persian that in spite of a relatively long history of these studies in the West, there has been less attention to them in Persian. Performing such researches is necessary because of the following reasons: contrary to extensive studies of written form, there has been less attention to speech (spoken) form and despite of significant researches in the field of neurology and cohesion devices, little researches has been done on the application of cohesion devices in the speech of elderly with Alzheimer and non-patients ones. Besides, since Alzheimer is one of the most important neurologic diseases that can affect on language and speech, it is necessary to study the cohesion devices in the speech of elderly with Alzheimer.

Materials and Methods

This descriptive-analytic research studied 12 monolingual Persian elderly (6 non-patients and 6 elderly with Alzheimer) that lived in nursing home and were matched with each other according to age (74-90 years old), sex (female) and education (max to fifth grade of primary school). Sampling has been conducted during 5 months with the approval of research and ethics committee of University of Sistan and Bluchestan and Welfare Organization of South Khorasan. Following the classification of the World Health Organization which divides ageing into three groups of young elderly (60-74 year), middle old elderly (74-90 year) and very old elderly (more than 90 year), the ageing criterion in this research was chosen between 74 to 90 years. Hence middle age elderly 6 non-patients elderly was chosen among the elderly who didn't have any illness or disorder except for ageing and they also had the entrance requirements.

The entrance requirements to this research included the elderly in the age range of 74 to 90 year, female and educated max to fifth grade of primary school and that they liked to participate in the research. The exit requirements included the elderly who were more educated and weren't in the

relevant age range of aging. Besides, according to doctor's confirmation and existing information in medical records, they had sight, hearing, motion problems and any other problem except for Alzheimer in speech and communication. These conditions and features fade out the process and results of the research. Sampling of elderly with Alzheimer was performed in a multistage form. In the first stage, we investigated the entrance requirements among the elderly who were living in the nursing homes of Birjand and Qaen cities or visited the psychiatrist. In this stage, 14 elderly didn't have the entrance features and were omitted from the research community. In the second stage, one of the researchers and the psychiatrist explained the aims and the procedure of performing the research to the families of remaining elderly (12 elderly) to ask them to cooperate and participate in the project and to get a permission to record their patients' voice. Among the mentioned elderly, 10 persons accepted to participate in the project, that the researchers chose 6 of them randomly. It should be noted that the elderly in this research were not exposed to risk. Their participation was voluntary and the elderly were free to withdraw at any time. In addition, all information obtained in sampling process via voice recording and testing was kept confidential.

On the other hand, one of the common methods of diagnosis of dementia of Alzheimer kind, as a precondition for more experiments and investigations, is Mini Mental State Examination test (MMSE). MMSE test is the most common used universal tool for cognitive impairment screening test. Folestein and his associates designed and developed this standard test in 1975. The west countries that faced with ageing since a number of decades ago developed the mentioned test. Problems of patients with Alzheimer have not been discussed due to its poor background leading from a low age average. Seyyedian and et al (1386) standardized the MMSE test in the elderly (15). In the mentioned research, the MMSE test has been performed on 7 elderly with Alzheimer and 7 non-patients ones in a pilot form. The research result indicated that the MMSE test with the score of 22 can segregate the elderly with dementia. In the present study, the psychiatrist recognized the Alzheimer. He determined the severity of the disease via the MMSE test (scores more than 25 show non-patients elderly, 10 to 19 mild Alzheimer and 10 sever Alzheimer with delusion.

Results

According to descriptive findings of the research, the age range of the subjects was 74 to 90 years old. They were women who passed maximum fifth grade of primary school. It should be noted that all the elderly with Alzheimer suffered from severe disease with delusion.

In this section, first, the frequency, percentage and average of lexical relations device application in the linguistic data of the two groups of non-patients and elderly with Alzheimer are described, and then analyzed and compared by using the independent T test.

Table 2. Frequency and percent of lexical relations device in the speech of non-patients people and people with Alzheimer

Lexical relations categories devices	Alzheimer Old		Non-patients Old	
	frequency	percent	frequency	percent
Collocation	9	45	18	24
Part-whole	5	25	24	32
Hyponymy	6	30	33	44
Sum of lexical relations device	20	100	75	100

As Table 2 shows, there exist 18 cases of collocation relations device in the speech of the non-patients which comprise 24% out of the sum of devices as well as 9 cases in the elderly with Alzheimer's data allocating 45% out of the total types of collocation relations. Based in normal elderly data only 24 cases is attributed to part-whole and in the elderly with Alzheimer, only 5.hence, 32% and 25% of the total devices is attributed to this device respectively in the non-patients and elderly with Alzheimer.33 cases of normal elderly involve hyponymy device including 44%of the total used devices.6 cases of the elderly with Alzheimer involve this device including 30% of the total device. Totally, application frequency of lexical relations devices is75 in the non-patients data and 20 in the speech of elderly with Alzheimer.

Table 3. Mean standard deviation and standard error of mean of lexical relations device in the speech of two groups of non-patients people and people with Alzheimer

Lexical Relations Categories Devices		Number	Mean	Std/ Deviation	Std/ Error Mean
Collocation	Non-patients old	6	3	1.67	0.68
	Alzheimer old	6	1.5	1.22	0.50
Part-whole	Non-patients old	6	4	2.61	1.04
	Alzheimer old	6	0.83	0.98	0.40
Hyponymy	Non-patients old	6	5.5	4.13	1.69
	Alzheimer old	6	1	1.09	0.45
Sum of lexical relations devices	Non-patients old	6	12.5	5.72	2.33
	Alzheimer old	6	3.33	1.97	0.80

Based on Table 3, the average of collocation device application ratio is 3 in the non-patients and1.5 in elderly with Alzheimer. This ratio is 4 in the speech of non-patients and 0.83 in the elderly with Alzheimer data. Therefore, the average of application ratio in the speech of both non-patients and elderly Alzheimer patients shows a significant difference. As well as the average of application ratio of hyponymy is 5.5 in non-patients and 1 in the data of elderly with Alzheimer. Finally the average of application ratio of lexical relations device is 12.5 in the speech of non-patients and 3.33 in the speech of elderly with Alzheimer. Therefore, application average of these devices in the speech of non-patients and elderly with Alzheimer shows the significant difference.

Table 4. T-test result of lexical relations categories devices

Lexical Relations Categories Devices		Levene's test for equality of variances		t-test for equality of means		
		F	P	T	Df	P
Collocation	Equal variances assumed	0.69	0.426	1.77	10	0.107
	Equal variances not assumed			1.77	9.16	0.110
Part-whole	Equal variances assumed	1.157	0.307	2.78	10	0.019
	Equal variances not assumed			2.78	6.39	0.030
Hyponymy	Equal variances assumed	6.54	0.028	2.58	10	0.028

	Equal variances not assumed			2.58	5.69	0.044
Sum of lexical relations devices	Equal variances assumed	11.57	0.007	3.71	10	0.004
	Equal variances not assumed			3.71	6.17	0.009

Table 4 shows the significance level of lexical relations device in elderly with Alzheimer and non-patients ones via T test. According to this table, for allocation device the freedom degree and statistic T are 10 and 1.772 respectively. Significance level is also $P=0.107$. Therefore there isn't statistically any significant difference between the application of collocation device in the speech of non-patients and elderly with Alzheimer. Besides T test shows that freedom degree and t are 10 and 2.78 respectively for the part-whole device and significance level is also $P=0.019$. Based on this, there is a significant difference in the speech of non-patients compared with elderly with Alzheimer. Furthermore , T test shows that in hyponymy device the freedom degree,t and significance level are respectively 5.69, 2.58 and $P=0.044$. Thus, statistically there is a significant different between the non-patients and elderly with Alzheimer. Finally Table 4 shows the freedom degree, statistic T and significance level for total lexical relations device in non-patients and elderly with Alzheimer data. These amounts are respectively equal to 6.17, 3.71 and $P=0.009$. Therefore there is a significant difference between the speech of non-patients and the elderly with Alzheimer.

Discussion

The analysis and comparison based on T test indicated that totally in lexical relations device except for collocation, the significance level is less than 0.05. Hence the total analysis of lexical relations device shows a significant different between the applications of this device in non-patients and elderly with Alzheimer.

There are also some researches and studies in the field of language disorders of patients with Alzheimer. Following Grossman, the elderly with Alzheimer have serious difficulty comprehending meaning of new vocabularies; however, they act the same as the non-patients elderly in learning parts of speech (8). This conclusion conforms to the current findings declaring there is also a possibility that patients with Alzheimer have comprehending the

meaning of nouns and verbs disorders. (Have difficulty comprehending…) Roux has also studied two skills of meaning cognition in early Alzheimer and found the change of word cognition, serious in this disease and a symptom for diagnosis (16).

Shahabi has also studied cohesion devices in patients with Alzheimer and found it was different compared with the non-patients one in grammatical and lexical devices (17). Furthermore, Mehri and Alami have aimed at the relationship between active memory and sentence comprehension in both patients with Alzheimer and the non-patients (10).

These findings in this research reveal that the elderly with Alzheimer are more prone to lose their active memory rather than the non-patients. (Have a decline in their active memory). The analysis of this research data and the previous ones presents the difference between language performance (function) of the elderly with Alzheimer and the non-patients one. Discourse analysis of the patients with Alzheimer shows they are ambiguous, cliché and without much attention. They even have difficulty naming objects. This conclusion approves of the previous findings indicating a considerable change in cohesion devices of discourse of the elderly with Alzheimer that of the non-patients. A major limitation of data collection procedure in this research was the refusal of elderly with Alzheimer s' families and nursing homes on the patients' voice recording. Therefore, the researcher had no choice but to move other cities in order to obtain consent of heads of nursing home for interviewing with the patients. Furthermore, most of patients, in the middle or final stage of procedure, spoke slowly as if maundering. Hence, the researcher had to use an MP3 with a higher sound quality and spend hours with patients. Another limitation was that sentences articulated by patients were ungrammatical and incorrect and made it difficult for data analysis.

This research was carried on only 12 patients with Alzheimer and the non-patients. Therefore, it is recommended to do this on larger samples and then comparing them for more valid and reliable consideration.

Conclusion

In the case of analyzing the various lexical relations applied as a cohesion device by senior patients both normal and suffering from Alzheimer's disease, the results of analysis indicated no significant difference in the method of applying these devices for normal and Alzheimer seniors in their collocation and lexical relations with the significance level.

On the other hand, for two other lexical relations

consisting of part whole and hyponymy, there was a significant difference between applying these two devices for both senior normal and Alzheimer patients. Most importantly, according to the overall analysis of all three investigated lexical relations and the significance of difference between applying these devices for the two test groups, it seems that this kind of difference indicates the effects of Alzheimer disease on employing the lexical relation device of speech for senior Alzheimer patients. Therefore, it can be said that Alzheimer's disease, at the highest level, can affect the functions of brain cells and induce linguistic-speech disorders.

Appendix

For dear reader's information, some definitions and samples of speech produced by non-patients seniors and those seniors who are suffering from Alzheimer are provided in the form of lexical relations such as, Collocation, part-whole metaphor and hyponymy.

- *Collocation*

Crystal (2008) calls collocation the simultaneous occurrence of typical single lexical elements which belong to the same lexical set.

1. Cloud and wind, moon and sun move in the sky That thou mayest gain bread, and not eat it unconcerned.

2. His wife was from Mashhad. They were relatives.

3. Hasan is standing, holding a tray, standing idly.

-*Part-whole metaphor*

According to Dooley and Levinson (2001), among all types of metaphor, only the part-whole metaphor can be used as cohesion device. "Part-whole means we call the whole and we desire a part or vice versa". (13) In example (4), "glasses" is a metaphor for eyes.

4. My glasses are blurred. (part–whole, non-patients senior)

In example (5) "head" is a metaphor for the entire body.

5. A car hit my head. (part–whole, senior with Alzheimer)

- *hyponymy*

When a concept consists of one or more other concepts, there is the hyponymy between the main concept and under-included concepts. (19). In example (6) the words "captain", "general" and "colonel" express a concept in military ranks and they have hyponymy.

6. My brother is a captain. The general is Colonel Ali Hedayati. (senior with Alzheimer)

In expamle (7), "knee", "back" and "hip" have hyponymy.

7. My husband fell and his knee is broken. His back is also broken from the hip. (non-patients senior)

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