Grammatical Processing in Schizophrenia: Analysis on Sentence Structure

Граматична обробка при шизофренії: аналіз структури речення

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ABSTRACT

Objective. Language disorder is one of the most significant symptom domains that characterizes Schizophrenia Disorder. The aim of the present study carried out considering language deviations is to investigate and compare the schizophrenic patients’ and control group’s speech in terms of sentence structure.

Materials and Methods. The sample of the study consists of 50 patients diagnosed with schizophrenia according to the Diagnostic and Statistical Manual of Mental Disorders 4 (DSM-4) and 50 healthy subjects matched with these patients by age, gender and educational level. The narrative skills of the subjects in the study were evaluated with four oral expression tests, which were narrative picture test, story picture sequencing test, semi-structured speech test, and free speech test.

Results. As a result of the statistical and linguistic analyses, significant differences were found between sentence types’ of schizophrenic patients’ and control group’s speech. Considering the use of simple sentences, it was revealed that patients with schizophrenia used more simple sentences than the control group in all tests. On the contrary, when complex and compound sentences were examined, patients with schizophrenia used less complex and compound sentences than the control group in all tests.

Conclusion. The linguistics deviations found from the study are thought to be due to the schizophrenic thought disorder’s four relatively independent components: delusion; intrinsic thinking disturbance; formal thought disorder; and deficient real-world knowledge – a new concept.

Key words: Schizophrenia, syntax, sentence structure, language disorder, thought disorder.

Introduction

Schizophrenia is a devastating mental illness that affects 1.0% of the adult population worldwide. Symptoms of schizophrenia reflect abnormalities in multiple aspects of human thought, language, and communication. These include problems in distinguishing between verbalized thought and external speech (verbal auditory hallucinations), in perceiving and interpreting the world around us (delusions), in social interactions and motivation (negative symptoms), and in expressing thought through language (thought disorder) (Işık, 2006; Sadock et al., 2007). The characteristic symptoms of schizophrenia also involve dysfunctions in multiple cognitive and functional spheres that include perception, behavioral monitoring, capacity to experience pleasure, decision making, and attention (Vahia & Cohen, 2011). Because of these impairments, schizophrenia patients have a tendency to withdraw...
themselves from others and their inappropriate behaviors can make human relations difficult (Jablensky, 2000).

An impairment of verbal communication is also one of several diagnostic features of schizophrenia (de Boer et al., 2020). Dysfunction in both receptive language and speech production affects communication and worsens the quality of life of patients (Condray et al., 2002). Evidence now relates these linguistic difficulties in patients to changes in the language network, particularly in the inferior frontal and temporal cortices (Catani et al., 2011; Moro et al., 2015; Stevens et al., 1998), as well as hemisphere lateralization of language (Bleich-Cohen et al., 2009; Mitchell & Crow, 2005). Although these language impairments affecting communication have been examined under thought disorders in the past, based on the evidence obtained, in recent studies these impairments have started to be made based on language levels. It has been suggested in recent years that the pathological core of schizophrenia is linked to the human capacity for language (Crow, 1997). In particular, a loss of the ability to distinguish between one's own thoughts, self-generated speech, and incoming speech in patients with schizophrenia (Li et al., 2007; Spaniel et al., 2007) could provide a unified explanation for language impairments of schizophrenia patients (Ceccherini-Nelli & Crow, 2003; Crow, 1997, 2000a, 2000b).

The first studies about language experienced by schizophrenia patients started with Chaika (1974), and in the study titled “A linguist looks at ‘schizophrenic’ language”, the researcher found that patients were unsuccessful in pronouncing lexical units and making sense of words, had syntactic problems, and patients’ utterances were different from the utterances of healthy individuals. Wrobel (1990) also stated that the speech of the patients with schizophrenia tended to be short, concrete, uncertain and limited in quantity. Besides, even if the responses were long or sufficient enough, they consisted of little information in the speech content. Similarly, Yavuz (2008) revealed that patients with schizophrenia showed impaired abstract thinking and these deficits in abstract thinking caused them to run into substantial difficulties in social interactions during daily life and work life. Correspondingly, problems such as perseveration, distractibility, clanging, neologisms, echolalia, thought blocking and word salad started to come out.

Considering the impairments above, the language of schizophrenia patients has led researchers to conduct research in line with
language levels. At the level of lexical processing selective impairments have been reported in schizophrenic speech. Their speech is marked by flattened intonation and word-finding difficulties, despite the fact that their segmental phonology and morphological organization are normal (Chaika, 1990). At the level of syntactic processing, schizophrenic patients' speech is usually normal, with no relevant aberrations (Covington et al., 2005). However, their sentences may appear somehow simplified, characterized by reduced syntactic complexity (Fraser et al., 1986). Schizophrenic patients usually have problems in the pragmatic use of language. It has been commonly observed that dealing with non-literal language (such as sarcasms, proverbs, metaphors, irony, idioms, and indirect requests) is challenging (Langdon et al., 2002). In this study, impairments seen in schizophrenia were examined from the linguist’s viewpoint, to see how schizophrenia affects syntax, particularly sentence structure.

In this context, the aim of this study is to examine the sentences produced by schizophrenia patients and the control group from a structural perspective considering 3 sentence structures: simple, complex and compound.

**Methods**

**Subjects**

Permission was granted by the Medical School of Dokuz Eylül University’s Interference-Free Ethics Committee on June 6, 2013 with a decision numbered 2013/21-18 and numbered 1036-GOA prior to the start of the project. The study included 50 individuals diagnosed with schizophrenia according to DSM-IV after applying to Dokuz Eylül University’s Mental Health and Illness Department, as well as 50 healthy participants who were matched in terms of age, gender, and educational level. Power analysis was used to calculate the number of subjects in the study. This study was based on the number of schizophrenia patients residing in Turkey and Izmir. The prevalence of schizophrenia in İzmir was 0.85 percent at an average of 0.05, and 50 patients with a 0.05 error margin were included in this study.

The study included a control group from the province of İzmir. There was no neurological or psychological distress in the control
group. It was defined as the study's eligibility criteria for healthy people without a progressive central nervous system disease (Alzheimer’s, Parkinsonism, etc.), psychiatric disorder, sensory problems (visual problems, neglect, hearing problems, etc.), a history of a stroke or brain disorder (tumor, head trauma, etc.), substance abuse, language, speech, or learning problem story, or drug use known to affect cognition. Besides, participants’ mother tongue was Turkish, and volunteering for participation in the research was defined as the criteria for participation for healthy individuals. The demographic information of the subjects is as shown in Table 1.

### Table 1
**Demographic Characteristics of Schizophrenia Patients and Control Group**

<table>
<thead>
<tr>
<th></th>
<th>Schizophrenia (n=50)</th>
<th>Control Group (n=50)</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>41.98</td>
<td>41</td>
<td>p=0.60</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>17</td>
<td>p=1.0</td>
</tr>
<tr>
<td>Male</td>
<td>33</td>
<td>33</td>
<td>p=1.0</td>
</tr>
<tr>
<td><strong>Education Year</strong></td>
<td>10.9</td>
<td>11.21</td>
<td>p=0.94</td>
</tr>
</tbody>
</table>

As shown in Table 1, there was no significant difference in terms of age, gender, and education level between patients and healthy individuals. The study included 34 female subjects (17 schizophrenia-17 control groups) and 66 male subjects (33 schizophrenia-17 controls). 4 subjects in the schizophrenia group were primary school graduates, 5 subjects were secondary school graduates, 9 subjects were high school graduates and 7 subjects were university graduates. Similarly, 2 subjects in the control group were primary school graduate, 1 subject was a secondary school graduate, 15 subjects were high school graduates and 7 subjects were university graduates.

### Data Collection
The data collection process was carried out on Wednesdays between 2012 and 2014 at the Policlinic of Schizophrenia and Psychotic Disorders of the Department of Mental Health and Illness of the Medical Faculty of Dokuz Eylul University. A pilot study was conducted between 2011 and 2012 to investigate whether the patients had difficulty interpreting the photographs to be utilized or whether
the pictures corresponded with Turkish culture before the tests were implemented. Both the schizophrenia and control groups had no issues interpreting the two picture assessments utilized in the study as a result of this application. Before the application, the researcher verbally asked the participant questions to fill up the forms comprising demographic information (Participant Information Form). The data on these forms included factors such as age, gender, and educational attainment. In addition, participants were asked to confirm that they volunteered for the study and that they were okay with their voices being recorded. Each participant was instructed by the researcher and the participant's questions about the application were answered.

Each patient was interviewed individually in the psychologist’s office during the application process. To avoid distracting the patients, great care was taken to ensure that the room where the tests were performed was quiet. Following the collection of data on schizophrenia patients, all tests were administered to a control group that was age, gender, and educational level matched to the patients in the same order. A voice recorder was used to record the participants’ speech during the tests. The data was obtained using the Philips LFH0615 audio recorder, and the recordings were transcribed using Du Bois (1991).

**Materials and Procedure**

To determine sentence structures in the speech of schizophrenia patients and the control group in different narrative types, four tests were used, which were narrative picture test, story picture sequencing test, semi-structured speech test, and free speech test, and each subject was interviewed for about 15 minutes. The study’s first two tests were both visual tests. The first picture was a “Picnic” picture that was used to describe, and the second picture was a “Hat” picture that was made up of 12 pictures to tell a story. The first test was a picture of a picnic on the lake taken from the Western Aphasia test. The “Hat” picture was taken from the book “V osstanovleniye Reçu u Bolnix s Afaziey” (Aphasic Speech Rehabilitation Book) and it was related to the story of a man wearing a hat. The subjects were asked to tell the story by thinking about the connections among the pictures. Both pictures are considered easy to describe and each takes an average of 2 minutes. During the process, all subjects talked about each story and the pictures were shown to the subjects in the same order. To prevent a performance
decrease that might be caused by short-term memory problems (Wicksell et al., 2004), subjects could look at pictures until they had completed their tests.

Following the picture tests, the individuals were given two verbal tests with no visual information. The first verbal exercise led them to a question, whereas the second was about free speech, and the subjects were free to say whatever they wished. Subjects were asked what they thought about their country's position in recent years in the first verbal test, and they were tested on whether they could talk about anything they chose in the second verbal test without any assistance. Following that, the responses were assessed. Each test was recorded and the resulting audio recordings were transcribed into transcriptions based on the symbols indicated by Du Bois (1991).

**Data Analysis**

The data collected according to the method of the study was evaluated in terms of the aims of the study and analyzed statistically. In order to reach the results, descriptive statistics and frequency tables for all variables are given with cross tables and tests. In group comparisons of all tests, the t-test was used for symmetrical data, the chi-square test was used to reveal the relationship between aims and disease for non-symmetrical data, and the median test was used to determine the difference between groups. In line with the data obtained, the number of subjects for the chi-square test and the number of sentences for the median test were taken as a basis. In this context, in the tests of narrative picture, story picture sequencing, semi-structured speech, and free speech, the sentences formed by all groups were examined separately according to their sentence structure, and the groups were compared in terms of the number of sentences. While making this comparison, the t-test was used because of the symmetry in the data set and the sufficient sample size while comparing the groups for simple sentences.

**Ethical Standards**

The authors guarantee that the study was carried out in compliance with the Dokuz Eylül University Faculty of Medicine’s
Non-Interventional Ethics Committee. All participants signed a written informed consent form.

There was no funding received for the study's planning or execution, or for the writing of this article. There are no potential conflicts of interest for the authors to disclose.

**Results**

The data underlying this article are available in Mendeley Data Search (Özcan, 2021).

The findings obtained from this study, which examines the sentence structures produced by schizophrenia patients and the control group in different tests, are presented in tables below.

**Table 2**
*Comparison of Simple Sentences Used by Schizophrenia Patients and Control Groups in Narrative Picture Test*

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Subjects</th>
<th>Simple Sentence Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>t-test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schizophrenia</td>
<td>50</td>
<td>10.14</td>
<td>4.57</td>
<td>0.65</td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>Control</td>
<td>50</td>
<td>6.44</td>
<td>3.30</td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to the results in Table 2, a statistically significant difference was found between the schizophrenia patients and the control group in terms of simple sentence use in Narrative Picture Test (p=0.001). According to the findings, schizophrenia patients used more simple sentences than the control group. Since the data set was not symmetrical for complex and compound sentences, the chi-square test was used to reveal the relationship between the disease and sentence structure, and the median test was used to reveal the difference between the groups. The results obtained are as seen in Table 3.

As seen in Table 3, a statistically significant relationship was found between the disease and complex sentence use with 95.0% confidence, according to the results of the chi-square test in Narrative Picture Test. It was determined that schizophrenia affected the use of complex sentence use (Noun clause p=0.008, adjectival clause p=0.002, adverbial clause p=0.001). The median test results also showed that there
was a significant difference between the number of complex sentences used by schizophrenia patients and the control group. According to the findings, schizophrenia patients used less complex sentences than the control group in their speech (Noun clause p=0.044, adjectival clause p=0.046, adverbial clause p=0.025).

**Table 3**

*Chi-square and Median Test Findings for Complex and Compound Sentences Used by Schizophrenia Patients and Control Group in Narrative Picture Test*

<table>
<thead>
<tr>
<th>Sentence Structure</th>
<th>Schizophrenia</th>
<th>Control</th>
<th>Total</th>
<th>f(%)</th>
<th>Chi-square Test</th>
<th>Median Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex Sentence (Noun Clause)</td>
<td>Users</td>
<td>8</td>
<td>20</td>
<td>28.6</td>
<td>71.4</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>42</td>
<td>30</td>
<td>58.3</td>
<td>41.7</td>
<td>72</td>
</tr>
<tr>
<td>Complex Sentence (Adjectival Clause)</td>
<td>Users</td>
<td>14</td>
<td>29</td>
<td>32.6</td>
<td>67.4</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>36</td>
<td>21</td>
<td>63.2</td>
<td>36.8</td>
<td>57</td>
</tr>
<tr>
<td>Complex Sentence (Adverbial Clause)</td>
<td>Users</td>
<td>2</td>
<td>17</td>
<td>10.5</td>
<td>89.5</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>48</td>
<td>33</td>
<td>59.3</td>
<td>40.7</td>
<td>81</td>
</tr>
<tr>
<td>Compound Sentence</td>
<td>Users</td>
<td>3</td>
<td>21</td>
<td>12.5</td>
<td>87.5</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>47</td>
<td>29</td>
<td>61.8</td>
<td>38.2</td>
<td>76</td>
</tr>
</tbody>
</table>

Considering the use of compound sentences in the Narrative Picture Test, a significant relationship was found between the disease and compound sentence use (p=0.001). In other words, it was revealed that schizophrenia affected the use of compound sentences. The median test results also showed that there was a significant difference between the number of compound sentences used by schizophrenia patients and the control group (p=0.001). The number of the compound sentences in schizophrenia patients’ speech was found less than the control group’s.

As seen in Table 4, a significant difference was found between schizophrenia patients and the control group in terms of simple sentence use in Story Picture Sequencing Test (p=0.001). The mean use of simple sentences of schizophrenia patients was significantly higher than the mean of simple sentence use of the control group.
Table 4
Comparison of Simple Sentences Used by Schizophrenia Patients and Control Group in Story Picture Sequencing Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Subjects</th>
<th>Simple Sentence Mean</th>
<th>Std. Deviation</th>
<th>Std.Error</th>
<th>t-test p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schizophrenia</td>
<td>50</td>
<td>11.38</td>
<td>6.97</td>
<td>0.99</td>
<td>0.001</td>
</tr>
<tr>
<td>Control</td>
<td>50</td>
<td>5.55</td>
<td>3.20</td>
<td>0.46</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 5
Chi-square and Median Test Findings for Complex and Compound Sentences Used by Schizophrenia Patients and Control Group in Story Picture Sequencing Test

<table>
<thead>
<tr>
<th>Sentence Structure</th>
<th>Schizophrenia f(%)</th>
<th>Control f(%)</th>
<th>Total f(%)</th>
<th>Chi-square Test p value</th>
<th>Median Test p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex Sentence (Noun Clause) Users</td>
<td>27</td>
<td>40.3</td>
<td>40</td>
<td>59.7</td>
<td>67</td>
</tr>
<tr>
<td>Complex Sentence (Noun Clause) Non-users</td>
<td>23</td>
<td>69.7</td>
<td>10</td>
<td>30.3</td>
<td>33</td>
</tr>
<tr>
<td>Complex Sentence (Adjectival Clause) Users</td>
<td>13</td>
<td>28.3</td>
<td>33</td>
<td>71.7</td>
<td>46</td>
</tr>
<tr>
<td>Complex Sentence (Adjectival Clause) Non-users</td>
<td>37</td>
<td>68.5</td>
<td>17</td>
<td>31.5</td>
<td>54</td>
</tr>
<tr>
<td>Complex Sentence (Adverbial Clause) Users</td>
<td>25</td>
<td>34.7</td>
<td>47</td>
<td>65.3</td>
<td>72</td>
</tr>
<tr>
<td>Complex Sentence (Adverbial Clause) Non-users</td>
<td>25</td>
<td>89.3</td>
<td>3</td>
<td>10.7</td>
<td>28</td>
</tr>
<tr>
<td>Compound Sentence Users</td>
<td>22</td>
<td>33.8</td>
<td>43</td>
<td>66.2</td>
<td>65</td>
</tr>
<tr>
<td>Compound Sentence Non-users</td>
<td>28</td>
<td>80</td>
<td>7</td>
<td>20</td>
<td>35</td>
</tr>
</tbody>
</table>

As seen in Table 5, a significant relationship was found between the disease and the complex sentence use in Story Picture Sequencing Test. In other words, it was revealed that schizophrenia affected the use of complex sentences in Story Picture Sequencing Test (noun clause p=0.006, adjectival clause p=0.001, adverbial clause p=0.001). Median test results also showed a significant difference between the number of complex sentences used by schizophrenia patients and the control group. According to the results obtained, schizophrenia patients used complex sentences significantly less than the control group (Noun clause p=0.038, adjectival clause p=0.001, adverbial clause p=0.001).
Considering the use of compound sentences, a statistically significant relationship was again found between schizophrenia and compound sentence structure according to the results of the chi-square test (p=0.001). In other words, schizophrenia affected the use of compound sentences in this test. The median test results also showed that there was a significant difference between the number of compound sentences used by schizophrenia patients and the control group (p=0.001). The number of compound sentences used by schizophrenia patients was less than the number of compound sentences used by the control group.

**Table 6**
*Comparison of Simple Sentences Used by Schizophrenia Patients and Control Groups in Semi-Structured Speech Test*

<table>
<thead>
<tr>
<th>SEMI-STRUCTURED SPEECH TEST</th>
<th>Number of Subjects</th>
<th>Simple Sentence Mean</th>
<th>Std. Deviation</th>
<th>Std.Error</th>
<th>t-test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schizophrenia</td>
<td>50</td>
<td>5.90</td>
<td>4.50</td>
<td>0.63</td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>Control</td>
<td>50</td>
<td>2.52</td>
<td>2.08</td>
<td>0.30</td>
<td></td>
<td>0.001</td>
</tr>
</tbody>
</table>

As seen in Table 6, a statistically significant difference was found between the schizophrenia and control group in terms of simple sentence use in Semi-Structured Speech Test (p=0.001). The mean use of simple sentences of schizophrenia patients was significantly higher than the mean use of simple sentences of the control group.

Considering the use of complex sentences in Semi-Structured Speech Test, a significant relationship was found between schizophrenia and adjectival and adverbial clause use, according to the results of the chi-square test. In other words, it was revealed that schizophrenia affected the use of complex sentences (adjectival clause p=0.004, adverbial clause p=0.001). In addition, median test results showed a significant difference between the number of complex sentences used by schizophrenia patients and the control group. According to the results obtained, schizophrenia patients used significantly less adjectival clause (p=0.007) and adverbial clause (p=0.001) than the control group. However, no relationship (p=0.316) or difference (p=0.28) was found between the disease and the use of noun clause in this test. The use of noun clauses in both groups was close to each other.
### Table 7

**Chi-square and Median Test Findings for Complex and Compound Sentences Used by Schizophrenia Patients and Control Group in Semi-Structured Speech Test**

<table>
<thead>
<tr>
<th>Sentence Structure</th>
<th>Schizophrenia Users</th>
<th>Control Non-users</th>
<th>Total f(%)</th>
<th>Chi-square Test p value</th>
<th>Median Test p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex Sentence (Noun Clause)</td>
<td>24</td>
<td>26</td>
<td>53</td>
<td>0.316</td>
<td>0.28</td>
</tr>
<tr>
<td>Complex Sentence (Adjectival Clause)</td>
<td>12</td>
<td>38</td>
<td>38</td>
<td>0.004</td>
<td>0.007</td>
</tr>
<tr>
<td>Complex Sentence (Adverbial Clause)</td>
<td>4</td>
<td>46</td>
<td>43</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Compound Sentence</td>
<td>18</td>
<td>32</td>
<td>43</td>
<td>0.157</td>
<td>0.226</td>
</tr>
</tbody>
</table>

### Table 8

**Comparison of Simple Sentences Used by Schizophrenia Patients and Control Groups in Free Speech Test**

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Subjects</th>
<th>Simple Sentence Mean</th>
<th>Std. Deviation</th>
<th>Std.Error</th>
<th>t-test p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schizophrenia</td>
<td>50</td>
<td>7.78</td>
<td>5.75</td>
<td>0.81</td>
<td>0.001</td>
</tr>
<tr>
<td>Control</td>
<td>50</td>
<td>3.56</td>
<td>2.89</td>
<td>0.40</td>
<td></td>
</tr>
</tbody>
</table>

As seen in Table 8, a statistically significant difference was found between the schizophrenia and control group in terms of simple sentence use in Free Speech Test (p=0.001). The mean use of simple sentences of schizophrenia patients was significantly higher than the mean use of simple sentences of the control group.

When complex sentences in Free Speech Test were examined, a significant relationship was again found between schizophrenia and the use of adjectival (p=0.001) and adverbial clauses (p=0.024), but no
significant relationship was found in the use of noun clauses (p=0.105). Considering the median test results, a significant difference was also found between the number of complex sentences used by schizophrenia patients and the control group. According to the results, schizophrenia patients’ adjectival (p=0.001) and adverbial clause (p=0.040) use was significantly less than the control group.

Table 9
Chi-square and Median Test Findings for Complex and Compound Sentences Used by Schizophrenia Patients and Control Group in Free Speech Test

<table>
<thead>
<tr>
<th>Sentence Structure</th>
<th>Schizophrenia</th>
<th>Control</th>
<th>Total</th>
<th>Chi-square Test p value</th>
<th>Median Test p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex Sentence (Noun Clause)</td>
<td>Users</td>
<td>25</td>
<td>43.1</td>
<td>33</td>
<td>56.9</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>25</td>
<td>59.5</td>
<td>17</td>
<td>40.5</td>
</tr>
<tr>
<td>Complex Sentence (Adjectival Clause)</td>
<td>Users</td>
<td>12</td>
<td>28.6</td>
<td>30</td>
<td>71.4</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>38</td>
<td>65.5</td>
<td>20</td>
<td>34.5</td>
</tr>
<tr>
<td>Complex Sentence (Adverbial Clause)</td>
<td>Users</td>
<td>14</td>
<td>35.9</td>
<td>25</td>
<td>64.1</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>36</td>
<td>59</td>
<td>25</td>
<td>41</td>
</tr>
<tr>
<td>Compound Sentence</td>
<td>Users</td>
<td>14</td>
<td>31.8</td>
<td>30</td>
<td>68.2</td>
</tr>
<tr>
<td></td>
<td>Non-users</td>
<td>36</td>
<td>64.3</td>
<td>20</td>
<td>35.7</td>
</tr>
</tbody>
</table>

Discussion and Conclusion

In this study, sentences produced by schizophrenia patients and the control group were compared in terms of their structures using four different language tests. A statistically significant difference was found between the schizophrenia patients and the control group in terms of simple sentence use in narrative picture test, story picture sequencing test, semi-structured speech test, and free speech test. In all tests, it was found that the number of simple sentences in schizophrenia patients’ speech was higher than the number of simple sentences in the control group.
group’s speech, and the number of complex and compound sentences was lower than the number of complex sentences in the control group’s speech. The results showed that patients with schizophrenia preferred simple structures instead of using complex and compound structures in communication. Although there were not syntactic errors in the speech, they used complex and compound structures by simplifying because of the problems with attention and concentration. It is also thought that simplification of sentences might be caused by cognitive problems. Apart from this, the syntactic simplifications of these patients, who have difficulty establishing relationships between the semantic networks in the mental lexicon, might be due to the problems they experience in combining syntactic and semantic knowledge and deciding on thematic roles.

The findings are similar to other studies in the literature. DeLisi (1997, 2001) was the first to note that syntactic simplification in schizophrenia and use a literature review to show that linguistic impairment is widespread in schizophrenia. She ran an experiment based on Bickerton’s list of five different features of human language, and in her study only phrasal complexity (as evaluated by total amount of speech, clause conjunction, and clause embedding) was shown to be reduced in schizophrenia, and this reduction was found to be familiar and co-segregated with schizophrenia (it tended not to afflict non-schizophrenic members of the families). This was a significant link between the genetics of language and the genetics of schizophrenia. In another study, it was found that subsequent analyses of the speech produced by patients with schizophrenia showed that their speech was more grammatically deviant (Hoffman & Sledge, 1988) and less syntactically complex than that of controls (Sanders et al., 1995).

Likewise, Condray et al. (2002) addressed an unresolved question in the literature: whether receptive syntax is intact in schizophrenia. The findings revealed that patients and controls differed in their overall comprehension accuracy about relative sentences, with patients exhibiting a 14 percent reduction in overall accuracy when compared to controls. More important, patients and controls differed in their pattern of accuracy, and this pattern was a function of syntactic structure. The findings provided a refinement of the previous literature in which it had been shown that patients are sensitive to syntactic structure but are characterized by reduced comprehension of grammatically complex
sentences. Condray et al. (2003) found a significant relationship between diagnosis, syntactic structure, and temporal demand. Patients were characterized by reduced overall comprehension accuracy compared to controls. More important, patients and controls differed in their patterns of accuracy across the different types of syntactic structure. Finally, cognitive functions predicted but did not completely account for comprehension accuracy. These findings suggest the hypothesis that receptive syntax is disrupted in schizophrenia, and this dysfunction may not be entirely explained by compromised general cognitive ability.

Kircher et al. (2005) reported that schizophrenic patients had problems in the production of complex sentences in their study with fMRI and compared schizophrenia patients and the control group, and suggested that these problems were related to the 10th and 21st Brodmann areas. It is thought that patients have difficulty in producing complex sentences due to the problems experienced in these areas. Similarly, Özcan et al. (2016, 2017) discovered significant differences between simple sentence types in schizophrenia patients and healthy subjects. As a result of the study, they concluded that due to the possible cognitive problems, patients with schizophrenia use shorter and simple sentences instead of complex sentences compared to healthy subjects. In the study by Fraser et al. (1986) in which they compared the control group, schizophrenia and manic patient groups, they stated that schizophrenic patients used less complex sentences.

Other studies on sentence structure have found that patients with schizophrenia have difficulty understanding and producing complex sentences (Thomas et al., 1996; Bagner et al., 2003). Rodriguez-Ferrar et al. (2001), on the other hand, argued that these deviations in the syntactic plane are not caused by impaired semantic processing but by thought disorders. In addition to these, demands for integrating semantic with syntactic information are often maximal at points of syntactic complexity and ambiguity (Traxler et al., 2002; MacDonald et al., 1994; Tanenhaus et al., 1995). Thus, an impairment in combining syntactic and semantic information to build up context can be a characteristic of schizophrenia as a whole and when this integration breaks down entirely such that language processing becomes dominated by semantic associations between individual words.

Additionally, Özcan Vural and Kuruoğlu (2020) hypothesized that language used by patients with schizophrenia plays a central role in this
disease than commonly supposed and the phenomena of schizophrenic language can be regarded as reflections of a more basic disturbance of thought. Based on this hypothesis, at the end of the study, patients were concluded to have simplified speech in addition to the disorganized speech defined in the field. The reason for this simplification was thought to be because of the predicate processing in the brain. The complement of a verb is always a noun phrase, which can be simple or complex. The patients tended to use nominal predicates more as they did not require any constituents, and thus they simplified their speech because of their language and thought disorders.

Tavano et al. (2008) highlight the influence of task type on the overall clinical profile of speech and language disorders in schizophrenia. In the narrative task, where a subject’s speech is guided by an ordered set of pictures, patients produced less words and propositions than healthy controls. Furthermore, they tended to repeat the words they had initially selected throughout the story, thereby yielding a significantly lower lexical diversity index than controls. As a result, an increase in syntactic complexity could simply burden additional cognitive functions that are used across a wide range of information processing tests (e.g., keeping incoming information online in short-term storage, accessing long-term memory and semantic knowledge networks, and processing sequential stimuli quickly) (Condray et al., 2002). It is also possible, however, that increased syntactic complexity requires the involvement of one or more additional functional components (e.g., transformation operations such as movement). An alternative explanation, therefore, is that disturbances in specific components of receptive syntax function may be responsible for patients’ reduced understanding accuracy about grammatically complex constructions.

In addition to the above-mentioned syntactic disorders, studies have also been conducted examining language disorders of patients with schizophrenia from different perspectives. These studies showed increased misidentification of high frequency and high phonologically similar words (Titone & Levy, 2004), difficulties in word stem completion (Marvel et al., 2004), and poor performance in lexical decision tasks (Vinogradov et al., 2003). Anomalies in semantic processing of words have also been reported in studies (Goldberg et al., 1998; Vogel et al., 2009).
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References


Crow, T.J. (2000a). Invited commentary on: Functional anatomy of verbal fluency in people with schizophrenia and those at genetic risk: the genetics of asymmetry


АНОТАЦІЯ
Мета. Порушення мовлення є одним із найбільш показних симптомів, що характеризують розлад шизофрении. Мета дослідження, проведеного з урахуванням мовленнєвих відхилень, – вивчити і порівняти мовлення хворих на шизофрению експериментальної та контрольної груп з точки зору структури речення.
Матеріали та методи. Вибірка дослідження складається з 50 пацієнтів з діагнозом шизофрения відповідно до Діагностичного та статистичного довідника психічних розладів 4 (DSM-4) та 50 здорових досліджуваних, різних за віком, статтею та рівнем освіти. Операції розповідання досліджуваних оцінювалися за допомогою чотирьох тестів мовлення, а саме: тест з картинками, тест на послідовність картинок, напівструктурований мовленнєвий тест і тест вільного мовлення.
Результати. У результаті статистичного та лінгвістичного аналізу були виявлені значні відмінності між типами речення у мовленні хворих.
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на шизофренію та здорових людей контрольної групи. Якщо розглядати використання простих речень, було виявлено, що пацієнти з шизофренією використовували більше простих речень, ніж здорові люди контрольної групи у всіх тестах. Пацієнти з шизофренією використовували менше складних та складнопідрядних речень, ніж здорові люди контрольної групи у всіх тестах.

Висновки. Виявлені в ході дослідження лінгвістичні відхилення, як передбачається, обумовлені чотирма відносно незалежними компонентами розладу шизофренічного мислення: маренням; внутрішнім порушенням мислення; формальним розладом мислення; недостатніми знаннями реального світу.

Ключові слова: шизофренія, синтаксис, структура речення, розлад мовлення, розлад мислення.