

An analysis of complex sentence structures in patients with schizophrenia

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Abstract

Patients with schizophrenia often display unusual language impairments and these abnormalities in language are among the most extreme and obvious symptoms in Schizophrenia Disorder. In this context, this research attempts to analyze and compare the schizophrenic patients' and control group's speech in terms of complex sentence structures. Fifty patients with schizophrenia diagnosed according to DSM-IV criteria have been included in the study and compared to fifty healthy subjects matched for age, sex and education level with the patients. The subjects' speech has been evaluated in four stages. These are narration, story picture sequencing, semi-structured speech and free speech. The data consists of 8-10 minute recorded interviews. The recordings have been transcribed based on DuBois' Discourse Transcription Symbols. The statistical and linguistic analyses have shown significant differences between complex sentence types' of patients with schizophrenia and healthy subjects'. The findings have demonstrated that due to the possible cognitive problems the speech produced by schizophrenia patients is syntactically less complex than that of controls. Additionally, patients with schizophrenia use shorter and simple sentences instead of complex sentences compared to healthy subjects.

Keywords: schizophrenia, sentence structure, complex sentence, language disorder, thought disorder.

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1. Introduction

Abnormalities in language are among the most extreme and obvious symptoms in Schizophrenia Disorder. Many patients diagnosed with schizophrenia display deficits in cognitive processes and in language. This chronic and severe mental disorder that interferes with a person's ability to think clearly, manage emotions and make decisions also cause some problems in distinguishing between verbalized thought and external speech (verbal auditory hallucinations), in perceiving and interpreting the world (delusions), in social interactions and motivation (negative symptoms), and in expressing thought through language (thought disorder) (İsik, 2006; Sadock, Sadock, Aydin & Bozkurt, 2007). Schizophrenia patients have also a tendency to withdraw themselves from the others and their inappropriate behaviours can make human relations difficult (Jablensky, 2000). They show impaired abstract thinking and these deficits in abstract thinking cause 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 start to come out (Yavuz, 2008).

Symptoms of schizophrenia reflect abnormalities in multiple aspects of human language and these language problems are considered in different levels of language such as phonology, morphology, semantics or pragmatics. In this study, we survey schizophrenic language syntactically as there is evidence that the speech produced by patients with schizophrenia is syntactically less complex than that of healthy controls. In addition, patients show some deficits in comprehending long and grammatically complex sentences (Kuperberg, 2010). Subsequent analyses of the speech produced by patients with schizophrenia suggest that their speech is more grammatically deviant (Hoffman & Sledge, 1988) and less syntactically complex than that of controls (Sanders, Adams & Tager-Flusberg, 1995). Studies indicate higher percentage of simple and compound sentences, and fewer dependent clauses that are not deeply embedded (Fraser, King & Kendell, 1986; Morice & Ingram, 1982). In addition, patients with schizophrenia have some impairments in comprehending long and grammatically complex sentences. Patients' impairment in comprehending syntactically complex sentences correlates with their poor performance on a verbal working memory (WM) span task. These findings have generally been taken as evidence that syntactic impairments in schizophrenia are mediated by their WM dysfunction (Bagner, Melinder & Barch, 2003; Condray, Steinhauer, Van & Kasperek, 2002). Moreover, demands for integrating semantic with syntactic information are often maximal at points of syntactic complexity (Ferreira, 2003; Traxler, Morris & Seeley, 2002) and ambiguity (MacDonald, Perlmutter & Seidenberg, 1994; Tanenhaus, SpiveyKnowlton, Eberhard & Sedivy, 1995). Thus, it is possible that an impairment in combining syntactic and semantic information to build up context is characteristic of schizophrenia as a whole and that thought disorder manifests clinically only when this integration breaks down entirely such that language processing becomes dominated by semantic associations between individual words. Within this context, the aim of the present study which has been carried out by taking into consideration these language problems is to investigate and compare the schizophrenic patients' and control group's speech in terms of complex sentence structures.

2. Methodology

2.1. Subjects

Prior to data collection, in order to make a research with the patients, an approval has been obtained from the ethical committee of Dokuz Eylul University on 06.06.2013. Fifty patients with schizophrenia receiving treatment in Dokuz Eylul University, School of Medicine, Department of Psychiatry and diagnosed according to DSM-IV criteria and fifty healthy subjects, who have been matched for age, sex and education level with the patients, have been included in the study. Power analysis has been conducted with regards to the number of the patients living in İzmir as 0.85 % of total population and difference between patients with schizophrenia and healthy subjects in speech disorder with $\alpha = 0.05$ significance level. As a result of this power analysis, fifty patients with schizophrenia and fifty healthy subjects were included in this research. Table-1 shows the demographic information of the patients and healthy individuals.

Table 1. Demographic Information of the Patients with Schizophrenia and Healthy Subjects

	Schizophrenia (n=50)	HealthySubjects (n=50)	<i>p value</i>
Age	41.98	41	$p=0.60$
Sex			
Women	17	17	$p=1.0$
Men	33	33	$p=1.0$
Education Level	10.9	11.21	$p=0.94$

2.2. Procedure

Data collection was carried out at Dokuz Eylul University, Department of Psychiatry on Wednesdays between 2012 and 2014. Subjects who have been given a written informed consent have been tested one to one in a psychologist' room. In order not to distract patients' attention, the research room has always been kept silent during the task. After evaluating the patients, healthy subjects matched for age, sex and education level with patients have been tested in the same way. All subjects' speech has been recorded via Philips LFH0615 recorder and transcribed based on the symbols indicated by Du Bois (1991).

2.3. Task

Simple sentence structures of the patients with schizophrenia who have received treatment at Dokuz Eylul University, Department of Psychiatry have been evaluated in four stages which are narration, story picture sequencing, semi structured speech task and free speech task and each patient has been talked with approximately for 8-10 minutes. While the Picnic Picture, which is chosen from Western Aphasia test, has been used in narration, the picture, which is about the story of a man who buys a hat chosen from "VosstanovleniyeReci u Bolnix s Afaziey" book, has been used for story picture sequencing. Both pictures have been chosen by taking into account Turkish culture and subjects have not had any difficulties in making their comments. All tasks have been given to all subjects in the same order. Anderson (1988) and Wicksell, et. al (2004) indicated that problems in short-term memory are the most apparent, suggesting specific cognitive deficits can cause decrease in performance. In order to prevent these problems, subjects have been allowed to see the pictures during the test process. Following this task, they have been firstly asked to talk about the recent situation in Turkey and then have been asked to talk about anything they like. The interview has lasted nearly 8-10 minutes and all the subjects' speech has been recorded. The recordings have been transcribed based on DuBois' Discourse Transcription Symbols and sentence structures of healthy subjects and schizophrenic patients have been compared statistically.

2.4. Data Analysis

Data analyses have been conducted in two stages. First, a series of four linguistic measures which have shown differences between the patients with schizophrenia and healthy subjects have been examined. Following an assessment of these findings, further correlations have been examined separately for each task, using statistical tests. Chi square has been used to determine whether schizophrenia significantly affects complex sentence use and median has been used to find out the significance levels between patients with schizophrenia and healthy subjects by testing the equality of medians. When the analyses have been completed, the findings have been interpreted in consideration of relevant literature.

3. Results

This study has examined the complex sentence use of patients with schizophrenia and healthy subjects. Following the statistical analysis comparing the complex sentence number in both groups regarding narrative picture task, story picture sequencing task, semi structured speech task and free

speech tasks, the results have shown that patients with schizophrenia exhibited a decrease in complex sentence use. The results of narrative picture task are as shown in Table 2.

Table 2. Complex Sentence Use of Patients with Schizophrenia and Healthy Subjects in Narration Task

Narrative picture task		PATIENTS WITH SCH	f(%)	HEALTHY SUBJECTS	f(%)	TOTAL	f(%)	chi square <i>p value</i>	media n <i>p value</i>
Complex Sentence (Noun Clause)	Number of User	8	28.6	20	71.4	28	100	0.008	0.44
	Number of Nonusers	42	58.3	30	41.7	72	100		
Complex Sentence (Adjectival Clause)	Number of User	14	32.6	29	67.4	43	100	0.002	0.46
	Number of Nonusers	36	63.2	21	36.8	57	100		
Complex Sentence (Adverbial Clause)	Number of User	2	10.5	17	89.5	19	100	0.001	0.25
	Number of Nonusers	48	59.3	33	40.7	81	100		

As seen in Table 2, there has been a significant relation between schizophrenia disorder and complex sentence use. In other words schizophrenia disorder has affected this sentence type in narration task (noun-clause $p=0.008$, adjectival clause $p=0.002$, adverbial clause $p=0.001$). Median test also has indicated that there has been a significant difference between patients with schizophrenia and healthy subjects in complex sentence use. The results have shown that patients used significantly less complex sentences when compared to healthy subjects (noun clause- $p=0.044$, adjectival clause- $p=0.046$, adverbial clause- $p=0.025$)

Table 3. Complex Sentence Use of Patients with Schizophrenia and Healthy Subjects in Story Picture Sequencing Task

STORY PICTURE SEQUENCING TASK									
		PATIENTS WITH SCH	f(%)	HEALTHY SUBJECTS	f(%)	TOTAL	f(%)	chi square <i>p value</i>	median <i>p value</i>
Complex Sentence (Noun Clause)	Number of User	27	40.3	40	59.7	67	100	0.006	0.38
	Number of Nonusers	23	69.7	10	30.3	33	100		
Complex Sentence (Adjectival Clause)	Number of User	13	28.3	33	71.7	46	100	0.001	0.001
	Number of Nonusers	37	68.5	17	31.5	54	100		
Complex Sentence (Adverbial Clause)	Number of User	25	34.7	47	65.3	72	100	0.001	0.001
	Number of Nonusers	25	89.3	3	10.7	28	100		

Table 3 shows the results about complex sentence use in story picture sequencing task. As seen in the table a significant relation between schizophrenia disorder and complex sentence use was used, and schizophrenia disorder affected complex sentence type in this task too (noun-clause $p=0.006$, adjectival clause $p=0.001$, adverbial clause $p=0.001$). Likewise, significant differences between patients with schizophrenia and healthy subjects in complex sentence use were found and the patients used significantly less complex sentences than healthy subjects (noun clause- $p=0.038$, adjectival clause- $p=0.001$, adverbial clause- $p=0.001$).

Table 4. Complex Sentence Use of Patients with Schizophrenia and Healthy Subjects in Semi-Structured Task

SEMI-STRUCTURED TASK		PATIENTS WITH SCH	F(%)	HEALTHY SUBJECTS	F(%)	TOTAL	F(%)	CHI SQUARE P VALUE	MEDIAN P VALUE
Complex Sentenc e (Noun Clause)	Number of User	24	45.3	29	54.7	53	100	0.316	0.28
	Number of Nonusers	26	55.3	21	44.7	47	100		
Complex Sentenc e (Adjectiv al Clause)	Number of User	12	31.6	26	68.4	38	100	0.004	0.007
	Number of Nonusers	38	61.3	24	38.7	62	100		
Complex Sentenc e (Adverbi al Clause)	Number of User	4	10.5	34	89.5	38	100	0.001	0.001
	Number of Nonusers	46	74	16	25.8	62	100		

As seen in Table 4, there was a significant relation between schizophrenia disorder and adjectival clause and adverbial clause use, and schizophrenia disorder affected these sentence types in this task (adjectival clause $p=0.004$, adverbial clause $p=0.001$). Median test also indicated that there was a significant difference between patients with schizophrenia and healthy subjects in adjectival clause and adverbial clause use. The results showed that patients used significantly less adjectival clause and adverbial clause when compared to healthy subjects (adjectival clause- $p=0.007$, adverbial clause- $p=0.001$). In this task, noun clause use was similar for both groups and no significant relation ($p=0.316$) and difference ($p=0.28$) were found in this sentence types.

Table 5. Complex Sentence Use of Patients with Schizophrenia and Healthy Subjects in Free Speech Task

FREE SPEECH TASK		PATIENTS WITH SCH	f(%)	HEALTHY SUBJECTS	f(%)	TOTAL	f(%)	chi square <i>p value</i>	median <i>p value</i>
Complex Sentence (Noun Clause)	Number of User	25	43.1	33	56.9	58	100	0.105	0.157
	Number of Nonusers	25	59.5	17	40.5	42	100		
Complex Sentence (Adjectival Clause)	Number of User	12	28.6	30	71.4	42	100	0.001	0.001
	Number of Nonusers	38	65.5	20	34.5	58	100		
Complex Sentence (Adverbial Clause)	Number of User	14	35.9	25	64.1	39	100	0.024	0.040
	Number of Nonusers	36	59	25	41	61	100		

As seen in Table 5, the results found in free talk speech were similar with semi structured task. Likewise, there was a significant relation between schizophrenia disorder and adjectival clause and adverbial clause use in this task (adjectival clause $p=0.001$, adverbial clause $p=0.024$). The results show similarity in median test too. It was found that there was a significant difference between patients with schizophrenia and healthy subjects in adjectival clause and adverbial clause use (adjectival clause- $p=0.001$, adverbial clause- $p=0.040$). In this task noun clause use was again similar for both groups and no significant relation ($p=0.105$) and difference ($p=0.157$) were found in this sentence type.

4. Discussion

This study shows that the production of grammatically complex sentences is impaired in schizophrenia and impaired syntax processing reflects a risk for the disorder. The findings of this study are similar to the other studies. Chaika (1974) described some lexical and syntactic errors. Subsequent analyses of the speech produced by schizophrenia patients suggested that it was less syntactically complex than that of controls (Fraser et al. 1986; Morice & Ingram, 1982). Kircher, Oh, Brammer & McGuire (2005) examined the neural correlates of syntax production in people with schizophrenia using functional magnetic resonance imaging (fMRI) and in the comparison between the groups, the number of complex sentences produced was correlated with activation in the posterior portion of the right middle temporal (Brodmann area 21) and left superior frontal (BA10) gyri in the control group but not in the patients. The authors also showed that activity within the posterior right middle temporal cortex and superior frontal cortex correlated with the number of syntactically complex sentences produced in the healthy controls but not the schizophrenia patients. The failure to recruit these regions was interpreted as contributing to patients' syntactically simpler speech.

In this study the speech produced by patients with schizophrenia was syntactically less complex compared to healthy subjects. In addition, in the research examining the deficits in comprehending long and grammatically complex sentences, patients were also found to have some impairments in comprehending syntactically complex sentences and their poor performance correlated with their poor performance on a verbal working memory span task. These findings have generally been taken as evidence that syntactic impairments in schizophrenia are mediated by their WM dysfunction (Bagner et al., 2003; Condray et al., 1996; Condray et al., 2002). In addition to these, demands for integrating semantic with syntactic information are often maximal at points of syntactic complexity (Ferreira, 2003; Traxler, Morris, & Seeley, 2002) and ambiguity (MacDonald, Perlmutter, & Seidenberg, 1994; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995). Thus, an impairment in combining syntactic and semantic information to build up context can be a characteristic of schizophrenia as a whole and this integration may break down entirely such that language processing becomes dominated by semantic associations between individual words.

Condray, Steinhauer, Van & Kasperek (2012) found significant relation between diagnosis, syntactic structure, and temporal demand. Patients were characterized by reduced overall comprehension accuracy compared to controls. More importantly, patients and controls differed in their patterns of accuracy across different types of syntactic structures. Finally, cognitive functions were 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.

Kuperberg (2006) tested the hypothesis that schizophrenia patients show impairments in building up context within sentences because of abnormalities in combining semantic with syntactic information. In their study, patients showed smaller reaction time differences than controls to animacy/semantically violated or morphosyntactically violated sentences relative to pragmatically/semantically violated or nonviolated sentences. The relative insensitivity to these violations in patients with schizophrenia is thought to arise from impairments in combining semantic and syntactic information to build up sentence context.

Covington, He, Brown, Naci, McClain, Fjordbak, Semple and Brown (2005) also surveyed schizophrenic language level by level, from phonetics through phonology, morphology, syntax, semantics, and pragmatics and found some impairments in thought or failure to maintain a discourse plan comprising various dysphasia-like impairments such as clanging, neologism, and unintelligible utterances. Thought disorder appeared to be primarily a disruption of executive function and pragmatics, perhaps with impairment of the syntax-semantics interface. Phonetics was also often abnormal (manifesting as flat intonation or unusual voice quality), but phonological structure, morphology, and syntax were nearly normal (some syntactic impairments have been demonstrated).

5. Conclusion

Symptoms of schizophrenia reflect abnormalities in multiple aspects of human language and these language problems are considered in different levels of language such as phonology, morphology, semantics or pragmatics. In this study, we have demonstrated whether syntax is intact or not in schizophrenia. Dwelling on the schizophrenic speech in terms of complex sentence structures, we have found that schizophrenia displays abnormalities of language. Results showed that patients and controls differed in their production of complex sentences, with patients exhibiting a significant reduction in their production, compared to controls particularly in adjectival and adverbial clauses. It is also revealed that patients tended to use less complex sentences and more simple or coordinated sentences while talking. As it is seen, patients tended to make syntactic simplifications. It was concluded that these conditions result from an overall cognitive deficit, difficulty concentrating, distraction, or a preference for expressing simpler ideas.

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