

Research Article

Language Aspects of Patients with Multiple Sclerosis

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Abstract

Objectives: Multiple Sclerosis (MS) is a chronic disease among the neurodegenerative disorders of the Central Nervous System (CNS). It affects the motor, sensory, cerebellar, cognitive, language functions, etc. Since beginning the identification of language functions abnormalities in MS, the language performance evaluating provides the significant contribution to physicians in diagnosis and follow-up of the MS patients. Therefore, the aim of this study was to investigate the language aspects of MS from a linguistic perspective.

Methods: The study was conducted with 35 participants diagnosed with Relapsing Remitting MS (RRMS) and 35 controls. All of the study participants were asked about their life. Phonetic, morphological, syntactic, semantic, and pragmatic features of their speech were investigated. Statistical analyses were performed using PASW Statistics for Windows, Version 18.0 (SPSS Inc., Chicago, IL, USA) and $p < 0.05$ was considered significant.

Results: More linguistic errors were displayed by MS patients on every measure compared with the healthy subjects.

Conclusion: Speech analysis can provide additional contributions to clinicians evaluating language performance and abnormalities in patients with MS.

Keywords: Language aspects, linguistic view, multiple sclerosis

MS is one of the most common neurodegenerative chronic diseases of CNS which is characterized by a variety of symptoms that result from demyelination and inflammation along axons in multiple regions of the brain and spinal cord.^[1, 2] The disease affects women more than twice as much as men. The age of onset ranges between 20 and 40 years.^[3] MS etiology is still unknown but it is thought that MS is an autoimmune disease occurring in a genetically susceptible individual triggered by environmental factors.^[4-6] Although its course is unpredictable, clinical subgroups can be identified. At clinical onset, more than 85% of MS patients experience the exacerbation symptoms followed by periods of remission in which symptoms can disappear entirely.^[3, 5] This kind of form is called relapsing-remitting MS (RRMS). The other forms of MS are known as primary progressive MS (PPMS) and secondary progressive MS (SPMS).

Different areas in the brain are influenced by MS. More particularly, it produces lesions throughout the white matter, resulting in a range of neurological deficits which can affect the motor, sensory, cerebellar, cognitive, language functions, etc. Since beginning the identification of language function abnormalities in MS, the language performance evaluation provides a significant contribution to physicians in the diagnosis and follow-up of the MS patients.

Language disorders in patients with MS can sometimes be disabling and can manifest through motor speech aspects known as dysarthria, respiratory deficits, voice disorders like dysphonia, and a number of problems such as comprehension and expression.^[7-9] Generally in clinical practices, health care professionals evaluate the language aspects with naming and/or fluency tests^[10] whereas linguistic theory suggests that each facet of language be considered

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separately in order to come to a more thorough diagnosis. Simple naming and fluency tests, though revealing, do not give a complete picture of language function.^[11] These tests may have failed to identify more complex language processes. Various studies have reported naming and fluency difficulties among the population of MS.^[12, 13] In addition, reduced speed of lexical access is another inconsistently reported linguistic deficit.^[14] Moreover, the majority of research has reported competent reading, writing, and spelling feats as well as relatively intact comprehension skills in patients with MS. Inconsistent findings among researchers make it difficult to draw tangible results about language aspects in the population of MS.

It is conceivable that the assessment of the pragmatic dimension of language, comprising the structural components of language which appears when language is used to communicate in a social context, may draw a better frame for MS language aspects than naming and fluency tests. Using common clinical measures to examine pragmatic language ability in patients with MS might help to better characterize the language aspects of this population and suggest insight regarding the conflictive findings produced by standardized testing. The pragmatic use of language has been less well studied in patients with MS,^[10, 11] how they are affected still remains poorly understood. For this reason, the present study aims to investigate the language aspects of MS and determine the language aspects derived from natural language samples through the linguistic perspective.

Methods

Participants

This study was conducted on 35 subjects (22 males + 13 females) of chronological age between 18 and 60 years. All subjects were diagnosed with RRMS according to 2010 McDonald criteria by a professional neurologist. Participants with MS had no other co-existing neurological disorders. The patients' last attacks were before 3 months and their treatments were steroid free. The control group consisted of 35 subjects who matched the experimental group in terms of age and sex. Patients with MS were initially contacted by a neurology policlinic in order to protect patient privacy rights. All participants were native speakers of Turkish. They were reported to have neither a history of speech therapy nor a history of substance abuse. Furthermore, they were free from both past and present use of antipsychotic medication and did not use a hearing aid. Prior to the experiment, local Ethic statement was taken (protocol no: 46004091/302-14) and all participants were informed about the research then taken to the study who gave their consent.

Data Production

All participants were instructed to speak with the neurologist for twenty minutes about their life and background. They were also informed that the neurologist would only intervene if they began to struggle with their speech. Thus, the pragmatic language productions were almost undirected, with the participant having full freedom of speech. Whenever the participants stopped speaking for more than 5 seconds, the neurologist asked questions to encourage speech production in the participant. Open questions were preferred instead of closed questions that can be answered in a few words, so as to intervene as little as possible in the outputs of participants. In sum, the interference by the neurologist was kept as short as possible. This approach allows greater opportunity to observe an individual's communication^[15] and also it may be ensure determining their language aspects in clinical environment.

The participants' speeches was recorded using a digital voice recorder by the neurologist in a quiet room. Sound recordings were transcribed by the researchers according to procedures outlined in Systematic Analysis of Language Transcripts^[16] for subsequent analysis. Identification of language aspects were obtained from the transcribed and recorded data from the angle of phonology, morphology, syntax, semantics and pragmatics, respectively (Table 1).

According to linguistic perspective phonology, morphology, and syntax constitute the forms of language. Semantics states the content and pragmatics indicates the using of language (Fig. 1).

Data Analysis

The first step in the analyses was to create composite measures from SALT analyses. To examine the concordant language aspects between MS and healthy volunteers, linguistic measures were derived from the speech data. A linguistic composite was created by phonetic, morphologic, syntactic, semantic and pragmatic analyses.

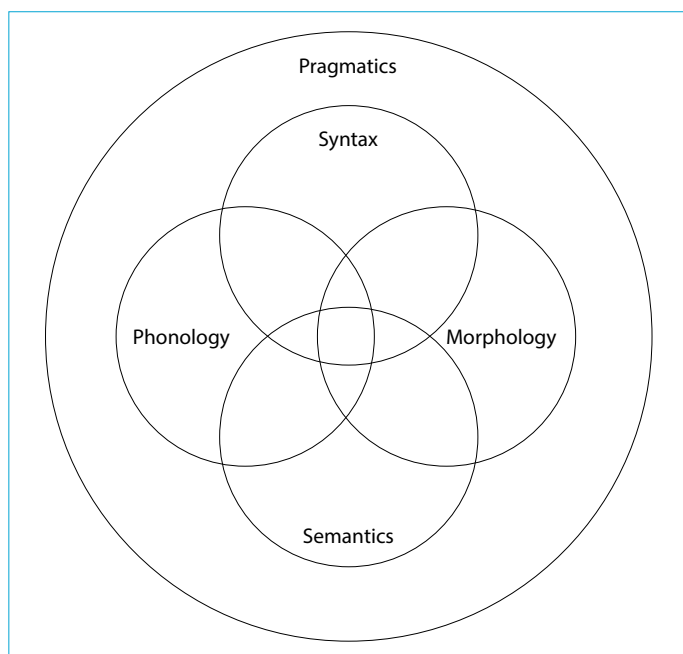
Statistical analyses were carried out in SPSS 18. Evaluation of descriptive datas were used the t-test, and The Mann-Whitney U test was used to search for comparing patients with MS and healthy controls. $p < 0.05$ was considered significant.

Results

The study was conducted on 35 (22 male+13 female) patients with MS and 35 (15 male+20 female) healthy volunteers matched by sex, age and education. Patients with MS group had a mean age of 32.50 years (SD=8.47 years), and their ages ranged from 20 to 56 years; subjects in the control group had a mean age of 28.15 years (SD=12.10 years), with ages ranging from 18 to 52 years. The education level

Table 1. Description of language measures

Linguistic system	Deficits
<p>Phonology Phonology is the study of the sound system of language, and includes the rules that govern its spoken form. Phonology analyzes which sound units are within a language and examines how these sounds are arranged, their systematic organization and rule system.^[17]</p>	<ul style="list-style-type: none"> • Frequently appear as articulation disorders. • Subject omits a consonant: "oo" for you • Subject substitutes one consonant: "wabbit" for rabbit • Discrimination: subject hears "go get the nail" instead of mail
<p>Morphology Morphology is the study of the structure of words; it analyzes how words are built out of morphemes, the basic unit of morphology. Morpheme is the smallest meaningful unit of a language.^[17]</p>	<ul style="list-style-type: none"> • Subject may not use appropriate inflectional endings in their speech (e.g., "He walk" or "Mommy coat"). • Subject may lack irregular past tense or irregular plurals (e.g., "drived" for "drove" or "mans" for "men"). <p>Be aware of "Black English": "John cousin" "fifty cent", or "She work here".</p>
<p>Syntax Syntax consists of organizational rules denoting word, phrase, and clause order. It also examines the organization and relationship between words, word classes, grammar of the language and other sentence elements.^[17]</p>	<ul style="list-style-type: none"> • Lack the length or syntactic complexity (e.g., "Where Daddy go?"). • Problems comprehending sentences that express relationship between direct or indirect objects. <p>Difficulty with wh questions. Difficulty with grammar of language (e.g. " mum went to work everyday)</p>
<p>Semantics Semantics is the study of linguistic meaning and includes the meaning of words, phrases, and sentences.^[17]</p>	<ul style="list-style-type: none"> • Limited vocabulary especially in adjectives, adverbs, prepositions, or pronouns. • Longer response time in selecting vocabulary words. • Fail to perceive subtle changes in word meaning: incomplete understanding and misinterpretations. • Figurative language problems.
<p>Pragmatics Pragmatic is the study of knowledge and ability to use language functionally in social or interactive situations and integrates all the other language skills, but also requires knowledge and use of rule governing the use of language in social context.</p>	<ul style="list-style-type: none"> • Problems understanding indirect requests (e.g., may say yes when asked "Must you play the piano?"). • May enter conversations in a socially unacceptable fashion or fail to take turns talking. • Difficulty staying on topic.

**Figure 1.** Language components and skills.

for patient in the MS group was 12.6 years (SD=1.64 years), indicating that on average, subjects had at minimum of a high school diploma. The education level of MS patients group ranged from 9 to 18 years. The education level for subjects in the control group was 10.41 years (SD=2.04 years), indicating that on average, participants in the control group had a minimum of a high school degree. The education level of control group subjects ranged from 10 to 16 years.

In neurological examination, patients with MS disability were assessed with the expanded disability status scale (EDSS). The mean EDSS score for the MS subjects was 2.87 (SD=1.36) ranged from 2 to 4 (Table 2).

Analysis of the patients with MS and control groups showed no significant difference among genders, as determined by a chi-square (χ^2) test of independence ($p=0.51$). Independent-samples t-tests indicated that the MS and control group subjects were similar in age, ($p=0.058$), and did not differ with regard to years of education ($p=0.063$).

Table 2. Demographic and clinical information of the subjects

	MS group			Control group		
	Mean±SD	Min.	Max.	Mean±SD	Min.	Max.
N		35			35	
Sex (M/F)		22/13			15/20	
Age	32.50±8.47	20	56	28.15±12.10	18	52
Education (Age)	12.60±1.64	9	18	10.41±2.04	10	16
EDSS	2.87±1.36	2	4		-	

Table 3. SALT data analysis for patients with MS and Control groups.

Variables	MS group (Mean±SD)	Control group (Mean±SD)	z	p
Phonetic error	74.7±44.52	41.61±10.87	-1.285	0.015
Morphologic error	140.42±2.68	84.57±26.98	-0.143	0.037
Syntactic errors	192.53±13.32	102.28±7.46	-2.085	0.026
Semantic error	84.65±35.78	54.85±4.26	-1.421	0.745
Pragmatic error	181.43±13.32	142.28±7.66	-2.176	0.030

Participants data was used to generate the SALT composites. A Linguistic composite was created with phonetic, morphologic, syntactic, semantic and pragmatic data to determine the language aspects of MS patients compared to healthy subjects. The data demonstrates an uneven spread of errors with most participants showing a slightly high number of errors in phonetic ($p=0.015$), morphologic ($p=0.37$), syntactic ($p=0.026$) and pragmatic ($p=0.030$) areas. This discrepancy between MS and healthy subjects was not observed in semantic errors ($p=0.745$) (Table 3)."

Discussion

The systematic assessment of complex speech abnormalities in MS has previously been limited to perceptual tests.^[18] These tests may have failed to identify more complex language processes. It is thought that the structural components of language which appear when language is used to communicate in a social context may draw a better frame for MS language aspects. From this point of view, the present study was to examine language aspects in spontaneous speech of patients with MS and compared to healthy controls. Speech samples were recorded from MS patients and healthy controls. After that they were transcribed into SALT format. First speech samples were analyzed for linguistic complexity using phonetic, morphologic, syntactic, semantic and pragmatic measures; then MS and control groups were statistically compared. Results from speech samples demonstrated that the MS patients displayed linguistic errors relatively higher in every measure than the healthy subjects. All these differences were found statistically significant except, interestingly, in semantic errors.

Unlike the majority of previous studies,^[10, 11, 19] our findings showed no statistically significant differences between MS patients and healthy controls on the semantic evaluation of speech samples, although patients with MS displayed semantic errors slightly higher than the control participants. Recently, Ebrahimipour et al.^[12] (2017) did not find significant differences on their work which was carried out with 90 Persian MS patients investigating semantic fluency. Similarly, Potagas et al.^[20] (2009) did not find significant differences in a semantic word list generation task with Greek MS patients. Nevertheless, semantic fluency and word finding tests have also been shown to be influenced by oral motor slowing.^[10] The discrepancies in the literature regarding the presence or absence of semantic deficits in patients with MS are probably attributable to a wide range of methodological differences involving sample selection and tests employed.^[21]

Speech impairment in patients with MS can sometimes be disabling and they can manifest themselves through motor speech aspects also known as dysarthria, voice disorders like dysphonia, and several sound impairments.^[7-9] Based on dysarthria, MS patients can face high level phonetic problems in daily life. The evaluation of dysarthria, by using a noninvasive acoustic analysis of vocal signal can represent a valid clinical support to otolaryngologists, neurologists, and speech pathologists for early and differential diagnosis and for documenting the disease progression.^[22] Also in the literature, clinical assessment of dysarthria in patients affected by MS, have been studied and reported statistically significant differences with respect to healthy subjects.^[22, 23] Rosen et al. (2008) researched the effects of MS on speech

production and they examined whether phonetic structure matters or not. They reported that dysarthria affects the production of extremely rapid changes in vowel formants and that some phonetic structures are more useful than others for detecting these impairments.^[24] A study on expressive phonology that was carried out by Kujala (1996) demonstrated phonological deficit in patients with MS.^[25] In parallel with previous studies,^[9, 22, 24, 26] our findings showed that MS patients displayed significantly greater phonetic errors when compared to the control group. In contrast to our study, Ivnik^[27] (1978) found no impairment with phonology in MS patients. Likewise, Koenig et al.^[28] (2008) did not find significant differences in their work which investigated phonological fluency and functional connectivity in MS used by clinical standardized test. The differences between the findings of these researches and our study may have occurred for several reasons, such as the levels of severity in participants, the language data collection tasks, and the phonetic measurements applied to the data.

It is known from the literature, MS patients have displayed syntactic failure,^[14] but measures of syntax show mixed evidence for impairment in MS. Grossman et al. (1995) examined the syntactic abilities of patients with MS using a picture-matching task. The stimuli were manipulated for grammatical voice and presence and location of a relative clause. Authors reported MS patients produced a significant predominance of grammatical and subject-object reversal errors compared to controls.^[29] Similar to Grosman et al. (1995), our findings demonstrated that MS patients displayed high level semantic errors which namely morpho-syntactic deficits, by producing irregular plurals and omitted morphemes. Morphological components have an important role in a syntactic phrase. To an extent, it can be conceivable that morphology sits at the interface of syntax. Because of this relation between morphologic and syntactic components, morphological errors directly affect the syntactic phrase. It also causes language deficits. Our results showed MS patients perform syntactic errors which generally arise from morphologic errors in their spontaneous speech.

Language production is a vital component of everyday social interaction and communication. Impairment of this capacity may lead to the inadequate transmission of ideas and more frequent misunderstandings.^[10] For this reason, the pragmatic component of language has a crucial role in the framework of expression and communication. It has been reported that MS patients could also experience deficits in using pragmatic language in which the context-dependent aspects of meaning go beyond the structural components of language.^[10, 30] In line with the previous findings, our study results show the MS patients performed

pragmatic errors in their spontaneous speech. We think that pragmatic errors in MS majorly depend on cognitive impairment. Likewise, De Renzi and Vignolo^[31] (1962) pointed out that the cognitive impairment in their longitudinal study which indicated that patients with MS demonstrate deterioration in language comprehension. Similarly Arrondo et al.^[10] (2009) suggest that the pragmatic disability in MS patients arises from cognitive impairment.

Conclusion

In summary, patients with MS have pragmatic and structural deficits in language production, and these difficulties can be related with cognitive impairments and executive dysfunction in particular, although the possibility that dysarthria may be partly responsible for such differences cannot be disregarded.^[10] In this study we aimed to identify language aspects of MS from a linguistic point of view. We efforted to investigate structural and pragmatic components of language aspects in MS via spontaneous speech transcriptions using SALT measurement. This measurement can ensure more contributions to clinicians when they are evaluating the language performance in MS.

Our study has, however, several limitations. The limited with sample size might also have prevented us from identifying all of the language aspects of MS. Also, a detailed analysis of language aspects using conversational or narrative speech measures may demonstrate other differences between patients with MS and healthy subjects. Future studies may concentrate on the development of more sensitive testing measures, both formal and informal, to identify the language aspects of MS and the use of larger sample sizes having a wider range of severity.

Disclosures

Ethics Committee Approval: The study was approved by the Local Ethics Committee (Protocol no: 46004091/302-14).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – A.R.S., Z.Z.B.; Design – A.R.S., Z.Z.B.; Supervision – A.R.S., Z.Z.B.; Materials – A.R.S., Z.Z.B.; Data collection &/or processing – A.R.S., Z.Z.B.; Analysis and/or interpretation – A.R.S., Z.Z.B.; Literature search – A.R.S., Z.Z.B.; Writing – A.R.S., Z.Z.B.; Critical review – A.R.S., Z.Z.B.

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