

Research Paper



Narrative Discourse in Persian-speaking Patients With Multiple Sclerosis

Zahra Ghayoumi-Anaraki¹ , Alireza Aghaz², Leila Ghasisin², Arash Shahriyari³, Ehsan Hemmati^{2*}

1. Department of Speech Therapy, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran.

2. Department of Speech Therapy, School of Rehabilitation Sciences, Isfahan University of Medical Sciences, Isfahan, Iran.

3. Department of Psychology, School of Rehabilitation Sciences, Central Tehran Branch, Islamic Azad University, Tehran, Iran.



Citation: Ghayoumi-Anaraki Z, Aghaz A, Ghasisin L, Shahriyari A, Hemmati E. Narrative Discourse in Persian-Speaking Patients With Multiple Sclerosis. Journal of Modern Rehabilitation. 2022; 16(1):61-68. <https://doi.org/10.18502/jmr.v16i1.8563>

<https://doi.org/10.18502/jmr.v16i1.8563>

Article info:

Received: 19 Mar 2021

Accepted: 03 May 2021

Available Online: 01 Jan 2022

Keywords:

Multiple Sclerosis, Linguistics, Narration, Language, Pragmatic, Speech

ABSTRACT

Introduction: Narrative discourse is a crucial subset of discourse production that can be used to assess high levels of language processing like microlinguistic and macrolinguistic structures. Because patients with Multiple Sclerosis (MS) have more problems at high levels of language processing, this study aims to analyze narrative discourse in MS patients and compare it with healthy people.

Materials and Methods: This research was a descriptive-analytic study. The study participants included 15 patients with MS and 15 healthy controls matched for age and education level. For investigating the narrative discourse, we used the Persian Narrative Discourse Test (PNDT). Data analysis was performed using descriptive statistics and the independent t-test in SPSS-24.

Results: The mean values of syntactic complexity, verbal error ratio, cohesion ratio, and coherence in Persian-speaking patients with MS were 1.40, 0.42, 1.18, 2.32, respectively. Our findings indicated that regarding the macrolinguistic measures, there is a significant difference between MS patients and healthy subjects ($P < 0.05$). However, there was no significant difference in the microlinguistic measures ($P > 0.05$).

Conclusion: This study showed that narrative discourse analysis could help identify linguistic and communication problems in MS patients. Patients with MS had pragmatic language disorder.

* Corresponding Author:

Ehsan Hemmati, MSc.

Address: Department of Speech Therapy, School of Rehabilitation Sciences, Isfahan University of Medical Sciences, Isfahan, Iran.

Tel: +98 (915) 989158090802

E-mail: hemmatie@yahoo.com



1. Introduction

Multiple Sclerosis (MS) is one of the most destructive neurological diseases. Besides, this disease is important because of its prevalence, onset, and tendency to engage in young adults [1]. The incidence of MS increases in both developed and undeveloped countries and is more common in females [2]. About 350000 Americans and more than 1.1 million people worldwide have MS [3]. MS in Iran has an incidence of 3.4 per 100000 and a prevalence of 29.3 per 100000 [4]. MS is commonly diagnosed in young adults and pathologically characterized by inflammation, demyelination, and glial scar in the central nervous system [5]. The peak age of onset of MS symptoms is between 20 and 30 and is rarely seen before 10 and after 60. The cause of MS is still unknown, but genetic predisposition, autoimmune mechanisms, and viral infections seem to play a role in developing this disease [6-8].

Acquired language disorders are not common in patients with MS. If it is created, it is usually due to a recurrence of the disease and usually will have a good recovery in language skills [9]. Language disorders in MS patients consist of cognitive impairment, naming problems, semantic errors, semantic paraphasia, defects in reading and writing, defect in the fluency of speech, and grammatical and syntactic problems, such as the number of spoken words and problems in high-level language skills [9-11].

Discourse production is a complex language process and one of the important and relevant forms of communication [12]. Commonly persistent discourse is analyzed through conversations and monologues. Also, monologues have superiority to conversational discourse [13]. Monologue discourse can be used to assess speech defects in MS patients [14], and one of the important types of monologue discourse is the narrative discourse that has been used recently in many studies [15, 16]. Narrative discourse is a complex cognitive function with different levels of language processing consisting of microlinguistic (within-sentence) and macrolinguistic (between-sentence) structures [17]. The abilities of microlinguistic include components within the sentence, such as morpho-syntactic and lexical aspects of language processing. The abilities of macrolinguistic include the skills of discourse and pragmatics of language, which is assessed through the errors of cohesion and coherence in discourse [18].

Limited studies have been conducted on the evaluation of language skills in Persian-speaking patients with

MS [19]. Freind et al. studied language abilities in MS patients. They concluded that these patients compared with the normal group, had lower scores in listening comprehension, naming, verbal fluency, and other cognitive skills based on language [20]. Feenaughty et al. examined the speed and timing of speech in MS patients and found that patients' performance was better in reading aloud than spontaneous speech [21]. Hence, loud reading seems to be less cognitive-linguistic than spontaneous speech. Arnott et al. examined the narratives in MS patients and showed that cognitive and pragmatic skills affect the performance of these individuals in the production of discourse [22]. Also, Arrondo et al. examined narrative speech in MS patients. Their results also showed that MS patients have structural problems during language production and that the flexibility of these patients is also deficient in producing a complex discourse that may be associated with cognitive problems, especially executive dysfunction. They also discovered that cognitive impairment could lead to problems with lexical access [13]. But so far, narrative discourse skills in Persian-speaking patients with MS have not been studied. Given the strong relationship between cognition and narrative discourse [23], cognitive interference should be minimized to assess better high-level language skills such as narrative discourse in patients with MS.

In general, studies of other languages have shown that MS patients have lower scores than normal populations in different language tests, and they have been damaged in discourse production. But no study has been conducted in this area in Persian-speaking patients with MS. Therefore, in this study, we intend to evaluate the narrative discourse in patients with multiple sclerosis and compare it with healthy individuals by controlling the interference of cognitive problems.

2. Materials and Methods

Study participants and design

The current study is cross-sectional descriptive-analytical research. The sample size consisted of 30 adults (15 patients with MS and 15 healthy control) selected through the available sampling method. The sampling process was done at Ayatollah Kashani Hospital in Isfahan for three months in the fall of 2019. In this study, all participants gave their informed consent.

The inclusion criteria for the patient group were as follows: the type of MS must be relapsing-remitting, patients must not have any prior language impairments before developing multiple sclerosis, they must be 18-45

years old, as we wanted patients without advanced MS and cognitive problems. So because the prevalence of MS is higher in adolescence, we had to select the patients from this age group. Also, MS patients over 45 have severe motor problems that prevent accurate assessments [24]. The inclusion criteria for the healthy control group were as follows: the participants must not have any prior dementia, brain stroke, or any neurological disorder experiences, and they must be 18-45 years old.

The participants were excluded if they had any prior mental disorder (n=0) or any psychedelic drug consumption experience (n=3) or expressed discontent with further involvement in the research (n=1).

We determined patients' eligibility using their medical records, a neurologist's diagnosis, and MRI to determine the type of multiple sclerosis. Healthy control participants were chosen from the patient's relatives based on the aforementioned criteria, and for each case, written informed consent was obtained. A psychologist assessed the participants' cognitive performance by the Persian version of the Mini-Mental State Examination (MMSE) [25]. The Persian Narrative Discourse Test (PNDT) was carried out by a speech pathologist on every participant separately [26]. All tests were carried out in the clinic where patients were hospitalized. The place was quiet and had proper lighting during the test.

Study instruments

PNDT is a storytelling task that consists of six serial pictures printed on an A3 paper [26]. The test assesses syntactic complexity, verbal errors, coherence, and cohesion in Persian-speaking adults. The reliability of these variables is also reported based on the Pearson correlation coefficient. The intra-rater reliability scores for syntactic complexity, verbal errors, coherence, and cohesion were 99%, 99%, 99%, and 99%, respectively ($P < 0.0001$ for all). The test-retest reliability scores for syntactic complexity, verbal errors, coherence, and cohesion were 83%, 75%, 89%, and 84% ($P < 0.02$ for all), respectively [26]. Syntactic complexity is calculated using the average number of clauses in each Communication unit (C-units) [27]. The verbal errors include phonological errors, mazes, and verbal or semantic paraphasias [28]. Phonological errors include semantic paraphasias (substitution of a word that has the same meaning as the target word), phonological paraphasias (substitution of a word that has formation and sounds similar to the target word), neologisms (unclear words), superordinate words, and overgeneralizations (e.g. using the word "fruit" instead of "apple"), redundancy

(explaining a word instead of using it) and repetition (sounds, words or phrases) [29]. We used the average of these errors in each C-unit to calculate the overall phonological errors. Mazes are filled pauses, repetitions, and revisions of words, syllables, or phrases [30]. Therefore, with the average of these items for each C-unit, we can evaluate mazes in speech as well.

Similarly, with the average of different types of cohesion, including references, ellipses, substitutions, lexical and conjunctions ties in each C-unit, we could evaluate the cohesion [31]. To evaluate coherence, we used the Wright scoring method and considered the average score of coherence in each C-unit [32]. It should be noted that PNDT does not have a total score, and we use the acquired average score for each of these criteria and cutoff points to assess our participants. The participant had to tell a story about what was happening in the serial illustrated story. In the process, if the subject hesitated more than 15 seconds, we encouraged him with the question: "can you tell me more?" No further instruction or training was given. The test was completed when the subject asserted that he had finished. The participant's speech was then transcribed by a speech pathologist. In the next step, all test components were evaluated and scored. The test duration was about 30 minutes for every participant.

The MMSE is a method for grading the cognitive state of patients. The overall score of this questionnaire is 30, and its cutoff score is 23, which indicates cognitive problems if a participant's score is lower than 23 [25].

Statistical analysis

In this study, the variables were presented as Mean \pm SD. As the number of participants was limited, we used the Q-Q plot to normalize the data and compared the mean score of two groups using the t-test. SPSS v. 24 was used, and the P value was set at 0.05 in all tests.

3. Results

In this study, 30 subjects participated (15 MS patients and 15 healthy people). All patients had relapsing-remitting MS. The age range of the participants was 18 to 45 years. The patients involved in this study suffered from MS for 2-15 years. Healthy control participants with no history of brain injury were matched for MS patients by age and education. None of our participants had any history of neurological disorders, aphasia, or psychiatric disorders. The demographic characteristics of the participants are presented in Table 1. There were no sig-

nificant differences between the groups in terms of age ($P=0.42$), gender ($P=1$), or level of education ($P=0.61$). All participants in the study scored above 23 on the Persian version of the MMSE. There were no significant differences between the two groups regarding the MMSE ($P=0.36$) (Table 1).

Comparing mean scores showed that healthy individuals had higher scores than MS patients in most components (syntactic complexity, cohesion ratio, and coherence) of the narrative discourse test (Table 2). Also, there was a significant difference between the two groups in the cohesion ratio ($P=0.01$) and coherence ($P=0.03$). But regarding the sentence complexity ($P=0.12$) and verbal errors ratio ($P=0.53$), no significant difference was found between the two groups. This finding means a significant difference in the macrolinguistic structure, but there is no significant difference in the microlinguistic structures.

4. Discussion

The main hypothesis of this study was that MS patients in narrative discourse had significantly lower perfor-

mance than the healthy controls. The results of our research partially agree with this hypothesis. Analysis of the scores of the two groups showed that MS patients in most variables had lower scores and thus poorer performance than the healthy control participants. The results clearly showed a significant difference between the MS patients and the healthy group in the macrolinguistic structures, including the coherence and cohesion ratio of the narrative. Also, in the syntactic complexity and verbal errors variables that are part of the microlinguistic structure, MS patients got lower scores than the healthy group, but this difference was not statistically significant. It should be noted, however, that the number of samples considered in this study was limited, which may be the limitation of this study, and the results should be interpreted with caution.

According to previous studies, coherence depends on flawless accessibility to semantic memory representations and perceptual and conceptual integrity, which is required for the overall organization and maintaining the plan of the discourse. Besides, mental manipulation and simultaneous attention to information are required to-

Table 1. Demographic information for patients with Multiple Sclerosis (MS) and healthy subjects ($n=30$)

Demographic Data	Mean \pm SD/No. (%)		P
	MS Patients ($n=15$)	Healthy Control ($n=15$)	
Age	36.8 \pm 8.3	35.5 \pm 9.8	0.42
Gender	Female	11(73.3)	1
	Male	4(26.7)	
Education, y	12.7 \pm 3.8	13.9 \pm 2.5	0.61
Duration of disease, y	8.0 \pm 4.8	-	-
MMSE score	27.64 \pm 2.3	28.81 \pm 1.2	0.36

JMR

Table 2. Narrative discourse analysis in patients with Multiple Sclerosis (MS) and healthy subjects ($n=30$)

Measures of PNDT	Mean \pm SD		P
	MS Patients	Healthy Subjects	
Syntactic complexity score	1.40 \pm 0.12	1.44 \pm 0.14	0.12
Verbal error ratio score	0.42 \pm 0.31	0.28 \pm 0.12	0.53
Cohesion ratio score	1.18 \pm 0.23	1.66 \pm 0.54	0.01*
Coherence score	2.32 \pm 0.17	3.07 \pm 0.38	0.03*

PNDT: The Persian Narrative Discourse Test; * $P<0.05$.

JMR

gether to produce a discourse with the proper coherence [33]. Since MS patients performed poorly on discourse coherence in this study, they may also have difficulties in each of these components.

Cohesion factors are divided into five categories [31]. These factors determine how people logically associate their utterances so that the listener can follow them. In this way, the narrator relates the meaning throughout the utterances by applying coherent factors [31]. According to the model of discourse processing levels, each type of cohesion falls into different levels [27]. Therefore, references, ellipses, and lexical cohesion are at the level of processing of linguistic units, but cohesion is generally at the level of processing of propositions. Consequently, according to the results of this study, MS patients have only weaker performance at the propositions processing level in narrative discourse.

The performance of MS patients in syntactic complexity was lower than that in healthy controls, but this difference was not significant. In terms of the idea and the main context of the story, the MS patients and healthy groups also performed similarly. Also, both groups have almost the same performance in organizing the ideas and the main context of the story. These results are inconsistent with those of Arnott et al. [22] and Arrondo et al. [13]. Arnott et al. reported that MS patients provide the less necessary information in telling their story, and therefore, the grammatical complexity of their narration is lower [22]. Because in this study, patients with MS did not have cognitive impairments based on the MMSE score. All the differences between the two groups, especially the poor performance of patients with MS in cohesion and coherence, are related to pragmatic language disorders of MS patients.

The patients with MS and healthy people do not have any notable differences in verbal errors of mazes type. The frequency of mazes was less in MS patients than healthy control participants, which confirms the study results by Friend et al. The mazes can be interpreted as a factor in linguistic planning and taken into account at certain grammatical points, such as between utterances [20]. Mazes can also be interpreted as a sign of verbal decision-making [34]. Since in this study, the syntactic complexity is lower in MS patients, they did not need verbal decision making and this, in turn, leads to a fewer number of mazes in their speech.

There is a close relationship between cognition and narrative discourse skills [23]. On the other hand, cognitive skills such as attention, information processing, ex-

ecutive functions, process speed, and long-term memory are the most important aspects of communication [35]. Therefore, the effect of cognitive problems on narrative discourse skills cannot be ignored in patients with MS. In this study, we tried to reduce the interference of cognitive problems. According to Table 1, the patients participating in the present study had no significant differences with the normal group in terms of cognitive problems ($P>0.05$). To ensure the accuracy of the results, we selected patients who had the least cognitive problems. Although in the present study, the confounding effect of cognitive problems on the narrative discourse of patients with MS was controlled, we should note that narrative discourse problems in MS patients may also be influenced by other factors such as psychological problems. El-Wahsh et al. showed that some patients with MS have frustration, embarrassment, loneliness, and limitations in social and family relationships [36], reducing their desire to produce a narrative discourse. Motor speech disorders or types of dysarthria in MS patients is another factor affecting the narrative discourse ability of these patients [37]. This state may create fatigue and reduce the range of motion of the muscles involved in speech production that can ultimately affect the quality and quantity of their narrative discourse. Also, since bilingualism in patients with MS can have a negative effect on the knowledge and verbal skills of these patients [38], bilingualism may also have a negative impact on narrative discourse skills. Therefore, in future studies, in addition to paying attention to cognitive problems, it is recommended to consider psychological disorders, motor speech disorders, and the bilingual or monolingual nature of patients with MS.

5. Conclusions

The results of this study can help to identify impairments of language and communication in Persian-speaking patients with MS. It also led to a better understanding of the language structures of narrative discourse in MS patients. Patients with MS had pragmatic language disorders. This work is the first exploratory study investigating narrative discourse in Persian-speaking patients with MS. Therefore, it is recommended to consider other macrolinguistic and microlinguistic structures of narrative discourse and control other factors affecting narrative discourse in future studies with larger sample size.

Ethical Considerations

Compliance with ethical guidelines

All participants completed the written informed consent. This study protocol was approved by the Ethics

Committee of Isfahan University of Medical Sciences, Isfahan, Iran (IR.MUI.REC.1396.1.093).

Funding

This work was financially supported by the Student Research Committee of the Faculty of Rehabilitation Sciences, Isfahan University of Medical Sciences, Isfahan.

Authors contributions

All authors equally contributed to preparing the article.

Conflict of interest

All authors declared no conflict of interest.

References

- [1] Filippi M, Rocca MA, Horsfield MA, Hametner S, Geurts JJ, Comi G, et al. Imaging cortical damage and dysfunction in multiple sclerosis. *JAMA Neurology*. 2013; 70(5):556-64. [DOI:10.1001/jamaneurol.2013.1954] [PMID]
- [2] Dobson R, Giovannoni G. Multiple sclerosis-a review. *European Journal of Neurology*. 2019; 26(1):27-40. [DOI:10.1111/ene.13819] [PMID]
- [3] Filippi M, Brück W, Chard D, Fazekas F, Geurts JJ, Enzinger C, et al. Association between pathological and MRI findings in multiple sclerosis. *The Lancet Neurology*. 2019; 18(2):198-210. [DOI:10.1016/S1474-4422(18)30451-4]
- [4] Azami M, YektaKooshali MH, Shohani M, Khorshidi A, Mahmudi L. Epidemiology of multiple sclerosis in Iran: A systematic review and meta-analysis. *PLoS One*. 2019; 14(4):e0214738. [DOI:10.1371/journal.pone.0214738] [PMID] [PMCID]
- [5] Geurts JJ, Calabrese M, Fisher E, Rudick RA. Measurement and clinical effect of grey matter pathology in multiple sclerosis. *The Lancet Neurology*. 2012; 11(12):1082-92. [DOI:10.1016/S1474-4422(12)70230-2]
- [6] Aghaz A, Alidad A, Hemmati E, Jadidi H, Ghelichi L. Prevalence of dysphagia in multiple sclerosis and its related factors: Systematic review and meta-analysis. *Iranian Journal of Neurology*. 2018; 17(4):180-8. [DOI:10.18502/ijnl.v17i4.592] [PMID]
- [7] Lassmann H. The pathologic substrate of magnetic resonance alterations in multiple sclerosis. *Neuroimaging Clinics of North America*. 2008; 18(4):563-76. [DOI:10.1016/j.nic.2008.06.005] [PMID]
- [8] Langdon DW, Amato MP, Boringa J, Brochet B, Foley F, Fredrikson S, et al. Recommendations for a brief international cognitive assessment for multiple sclerosis (BICAMS). *Multiple Sclerosis*. 2012; 18(6):891-8. [DOI:10.1177/1352458511431076] [PMID] [PMCID]
- [9] Lacour A, De Seze J, Revenco E, Lebrun C, Masmoudi K, Vidry E, et al. Acute aphasia in multiple sclerosis: A multicenter study of 22 patients. *Neurology*. 2004; 62(6):974-7. [DOI:10.1212/01.WNL.0000115169.23421.5D] [PMID]
- [10] Soltani M, Rahimifar P. Language disorders in multiple sclerosis. In: Baloyannis SJ. *Multiple sclerosis*. London: In-techOpen; 2020. https://www.google.com/books/edition/Multiple_Sclerosis/dpj8DwAAQBAJ?hl=en&gbpv=0
- [11] Mao-Draayer Y, Panitch H. Alexia without agraphia in multiple sclerosis: Case report with magnetic resonance imaging localization. *Multiple Sclerosis*. 2004; 10(6):705-7. [DOI:10.1191/1352458504ms1075cr] [PMID]
- [12] Cannizzaro MS, Coelho CA. Analysis of narrative discourse structure as an ecologically relevant measure of executive function in adults. *Journal of Psycholinguistic Research*. 2013; 42(6):527-49. [DOI:10.1007/s10936-012-9231-5] [PMID]
- [13] Arrondo G, Sepulcre J, Duque B, Toledo J, Villoslada P. Narrative speech is impaired in multiple sclerosis. *European Neurological Journal*. 2010; 2(1):1-8. <https://www.proquest.com/openview/a072bcb9d89db719c45bca07be2afaff/1?pq-origsite=gscholar&cbl=135343>
- [14] Armstrong E. Discourse across disorders: Acquired neurogenic conditions. In: Armstrong E. *Seminars in Speech and Language*. New York: Thieme Medical Publishers; 2012. [DOI:10.1055/s-0031-1301158]
- [15] Foka-Kavaliaraki P, Kakavoulia M, Economou A, Varlokosta S, Routsis C, Kasselimis DS, et al. A comprehensive approach to the analysis of narrative discourse production by Greek speakers with aphasia. Paper presented at the Science of Aphasia IX. 20-25 September 2008; Chalkidiki, Greece. http://users.uoa.gr/~aprotopapas/CV/pdf/Foka_etal_2008_SOA9.pdf
- [16] Beytollahi S, Soleymani Z, Jalaie S. The development of a new test for consecutive assessment of narrative skills in Iranian School-Age Children. *Iranian Journal of Medical Sciences*. 2020; 45(6):425-33. [PMID]
- [17] De Lira JO, Ortiz KZ, Campanha AC, Bertolucci PH, Minett TS. Microlinguistic aspects of the oral narrative in patients with Alzheimer's disease. *International Psychogeriatrics*. 2011; 23(3):404-12. [DOI:10.1017/S1041610210001092] [PMID]
- [18] Marini A, Galetto V, Zampieri E, Vorano L, Zettin M, Carlomagno S. Narrative language in traumatic brain injury. *Neuropsychologia*. 2011; 49(10):2904-10. [DOI:10.1016/j.neuropsychologia.2011.06.017] [PMID]
- [19] Rahimifar P, Soltani M, Moradi N, Madjdinasab N, Latifi SM. [A comparative study of repetition of long sentences skill in Persian-speaking multiple sclerosis patients and healthy subjects (Persian)]. *Koomesh*. 2017; 19(1):122-8. <http://koomeshjournal.semums.ac.ir/article-1-3408-en.html>
- [20] Friend KB, Rabin BM, Groninger L, Deluty RH, Bever C, Grattan L. Language functions in patients with multiple sclerosis. *The Clinical Neuropsychologist*. 1999; 13(1):78-94. [PMID]
- [21] Feenaughty L, Tjaden K, Benedict RH, Weinstock-Guttman B. Speech and pause characteristics in multiple sclerosis: A preliminary study of speakers with high and low neuropsychological test performance. *Clinical Linguistics & Phonetics*. 2013; 27(2):134-51. [PMID] [PMCID]

- [22] Arnott W, Jordan F, Murdoch B, Lethlean J. Narrative discourse in multiple sclerosis: an investigation of conceptual structure. *Aphasiology*. 1997; 11(10):969-91.
- [23] Hampe B. *Metaphor: Embodied cognition and discourse*. Cambridge: Cambridge University Press; 2017. [DOI:10.1017/9781108182324]
- [24] Chabok SY, Kapourchali SR, Leili EK, Saberi A, Mohtasham-Amiri Z. Effective factors on linguistic disorder during acute phase following traumatic brain injury in adults. *Neuropsychologia*. 2012; 50(7):1444-50. [DOI:10.1016/j.neuropsychologia.2012.02.029] [PMID]
- [25] Ansari NN, Naghdi S, Hasson S, Valizadeh L, Jalaie S. Validation of a Mini-Mental State Examination (MMSE) for the Persian population: A pilot study. *Applied Neuropsychology*. 2010; 17(3):190-5. [PMID]
- [26] Ghayoumi-Anaraki Z, Yadegari F, Behrooz M-B. *Persian Narrative Discourse Test*. Tehran: University of Welfare & Rehabilitation Sciences Press; 2016.
- [27] Ghayoumi Anaraki Z, Marini A, Yadegari F, Mahmoodi Bakhtiari B, Fakharian E, Rahgozar M, et al. Narrative discourse impairments in Persian-speaking persons with traumatic brain injury: A pilot study. *Folia Phoniatrica et Logopaedica*. 2014; 66(6):273-9. [DOI:10.1159/000371443] [PMID]
- [28] Lê K, Mozeiko J, Coelho C. Discourse analyses: Characterizing cognitive-communication disorders following TBI. *The ASHA Leader*. 2011; 16(2):18-21. [DOI:10.1044/leader.FTR4.16022011.18]
- [29] Ghayoumi Z, Yadegari F, Mahmoodi-Bakhtiari B, Fakharian E, Rahgozar M, Rasouli M. Persuasive discourse impairments in traumatic brain injury. *Archives of Trauma Research*. 2015; 4(1):e21473. [DOI:10.5812/atr.21473] [PMID] [PMCID]
- [30] Fiestas CE, Bedore LM, Peña ED, Nagy VJ, Cohen J, McAlister K. Use of mazes in the narrative language samples of bilingual and monolingual 4-to 7-year old children. Paper presented at: Proceedings of the 4th International Symposium on Bilingualism; 2005: Casaedilla Press.
- [31] Halliday MAK, Hasan R. *Cohesion in English*. London: Routledge; 2013. [DOI:10.4324/9781315836010]
- [32] Wright HH, Capilouto GJ, Koutsoftas A. Evaluating measures of global coherence ability in stories in adults. *International Journal of Language & Communication Disorders*. 2013; 48(3):249-56. [DOI:10.1111/1460-6984.12000] [PMID] [PMCID]
- [33] Glosser G, Deser T. Patterns of discourse production among neurological patients with fluent language disorders. *Brain and Language*. 1991; 40(1):67-88. [DOI:10.1016/0093-934X(91)90117-J]
- [34] Fagan WT. The relationship of the "maze" to language planning and production. *Research in the Teaching of English*. 1982; 16(1):85-95. <https://www.jstor.org/stable/40170880>
- [35] Power E, Weir S, Richardson J, Fromm D, Forbes M, MacWhinney B, et al. Patterns of narrative discourse in early recovery following severe traumatic brain injury. *Brain injury*. 2020; 34(1):98-109. [PMID]
- [36] El-Wahsh S, Heard R, Bogaardt H, Kumfor F, Ballard KJ. Variables associated with self-reported language impairment in multiple sclerosis: A regression analysis. *International Journal of MS Care*. 2021; 23(2):85-92. [DOI:10.7224/1537-2073.2020-096] [PMID] [PMCID]
- [37] Rusz J, Benova B, Ruzickova H, Novotny M, Tykalova T, Hlavnicka J, et al. Characteristics of motor speech phenotypes in multiple sclerosis. *Multiple Sclerosis and Related Disorders*. 2018; 19:62-9. [DOI:10.1016/j.msard.2017.11.007] [PMID]
- [38] Soltani M, Emami Dehcheshmeh SF, Moradi N, Hajiyakhchali A, Majdinasab N, Latifi SM, et al. Comparing executive functions in bilinguals and monolinguals suffering from relapsing-remitting multiple sclerosis. *Journal of Modern Rehabilitation*. 2018; 12(2):133-9. <https://jmr.tums.ac.ir/index.php/jmr/article/view/166>

This Page Intentionally Left Blank