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Comparison of Lexical and Grammatical Cohesion Devices in Individuals with Broca's Aphasia and Typical Individuals

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A B S T R A C T

Purpose: This study aimed to compare the use of lexical and grammatical cohesion devices in individuals with Broca's aphasia and typical individuals to identify specific discourse cohesion deficits associated with Broca's aphasia.

Methodology: This study employed a comparative research design using a descriptive-analytical approach. The participants included five individuals diagnosed with Broca's aphasia and five typical individuals matched for age, gender, and educational level. Speech samples were collected using a storytelling task, and the transcribed texts were analyzed for cohesion devices, including repetition, discourse markers, antonymy, reference, collocation, conjunctive elements, hyponymy, synonymy, and ellipsis. Data analysis was conducted using frequency distribution tables, chi-square tests for statistical significance, and qualitative discourse analysis to examine patterns of cohesion use in both groups.

Findings: The results indicated significant differences in the use of cohesion devices between the two groups ($p < 0.05$). Individuals with Broca's aphasia relied predominantly on repetition (34.50%) and ellipsis (33.33%) as primary cohesion strategies, whereas typical individuals demonstrated a more balanced use of cohesion devices, including reference (9.68%), conjunctions (9.27%), and hyponymy (5.91%). The chi-square test confirmed significant reductions in the use of complex cohesion devices in individuals with Broca's aphasia, particularly in reference, conjunctions, and lexical diversity. These findings align with previous studies on agrammatism and lexical access deficits in Broca's aphasia.

Conclusion: The findings suggest that Broca's aphasia predominantly affects grammatical cohesion, while lexical cohesion is preserved but simplified. The reliance on simpler cohesion devices highlights the need for targeted speech-language therapy to improve discourse coherence. Future research should explore interventions that enhance syntactic complexity and lexical diversity in individuals with Broca's aphasia.

Keywords: *Broca's aphasia, lexical cohesion, grammatical cohesion, Halliday and Hasan's cohesion theory*

1. Introduction

The theory of cohesion was first introduced by Halliday and Hasan (1976) within the framework of functional linguistics. In functional linguistics, language is regarded as a tool for communication and interaction within society, with its primary role being to establish communication (Aslanyan, 2023; Gonzalez et al., 2023). Cohesion theory describes and analyzes the factors and devices that contribute to the formation of spoken and written texts. Halliday and Hasan categorized cohesion devices into three types: grammatical, lexical, and conjunctive. Grammatical cohesion devices include reference, substitution, and ellipsis. Lexical cohesion devices consist of repetition, synonymy, antonymy, collocation, and hyponymy. Conjunctive cohesion devices encompass additive, temporal, causal, and adversative conjunctions (Muhtar, 2023).

Broca's aphasia is a language disorder that typically results from damage to Broca's area in the frontal cortex of the left hemisphere of the brain. This disorder is characterized by difficulties in language production, particularly in lexical and grammatical cohesion. Individuals with Broca's aphasia often struggle with forming complex sentences and correctly using grammatical structures and lexical cohesion devices. Their speech is typically telegraphic, meaning it is brief and lacks grammatical elements (Mumby & Roddam, 2020). Although these individuals experience significant difficulties in speech production, their comprehension of spoken language remains largely intact. In other words, they do not have deficits in speech comprehension. In contrast, typical individuals do not experience difficulties in either speech production or comprehension. They can effortlessly use complex grammatical structures and maintain lexical and grammatical cohesion in their speech (Goodglass et al., 2001).

Lexical and grammatical cohesion are key components in speech and writing, facilitating meaningful and structured connections between sentences and phrases (Muhtar, 2023). Lexical cohesion refers to the use of related words and expressions to create semantic links within a text or discourse and between sentences, whereas grammatical cohesion pertains to syntactic and grammatical structures and the use of grammatical rules to form coherent and comprehensible linguistic structures. Examining these two components in individuals with Broca's aphasia and comparing them to typical individuals can provide valuable insights into the nature of language disorders and rehabilitation strategies. Understanding the differences between individuals with Broca's aphasia and typical individuals in their use of these linguistic devices can contribute to a better understanding of linguistic mechanisms and the pathology of language disorders (Saffran et al., 1989).

Lexical cohesion refers to the ability to appropriately use words in speech and text, including selecting suitable vocabulary, employing synonyms, meaningful repetition, and establishing semantic connections between words (Thompson, 2001; Thompson & Shapiro, 2007). In individuals with Broca's aphasia, lexical cohesion is impaired due to word retrieval difficulties and vocabulary limitations, while grammatical cohesion, which involves syntactic structures such as word order, prepositions, auxiliary verbs, and other grammatical elements, is significantly affected, often leading to grammatically incomplete sentences (Iqbal, 2024; Zuppardo et al., 2023). Research on Broca's aphasia initially focused on general speech characteristics, revealing that affected individuals struggle with producing complex sentences and tend to omit conjunctions and functional words (Kertesz, 2006; Kiran & Thompson, 2003). Neurological studies indicate that aphasia results from damage to the frontal lobe, specifically Broca's area, which is primarily responsible for speech production (Yule, 2020). Individuals with Broca's aphasia often produce telegraphic speech and encounter difficulties in using conjunctions, auxiliary verbs, and inflectional morphemes, resulting in structurally deficient sentences (Thompson, 2001). Studies have shown that individuals with Broca's aphasia have a limited vocabulary, struggle with abstract words, and tend to use simple and repetitive lexemes (Kagan, 2007; Priestley, 2012). In terms of lexical retrieval interventions, research suggests that semantic complexity plays a role in treatment outcomes (Kiran & Thompson, 2003), while comprehension difficulties in syntactically complex sentences are a key characteristic of aphasia (Berndt et al., 1997; Berndt et al., 1996). Yule (2020) describes Broca's aphasia as a motor aphasia caused by damage to Broca's area in the left frontal lobe, a region first identified by Paul Broca in 1861. Studies on language deficits following strokes or brain injuries indicate that expressive abilities are more impaired than comprehension in Broca's aphasia, with grammatical morphemes being more vulnerable than content words, and verbs being more

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affected than nouns (Arianpour, 2007). Research comparing cohesion devices in stroke patients and healthy individuals found significant differences in personal and comparative reference use, although other cohesion markers did not show notable disparities (Yousefian, 2014). Additionally, Broca's and global aphasia patients exhibit a preference for short and simple sentences and struggle with using grammatical devices such as conjunctions and pronouns effectively, with aphasia severity influencing lexical and grammatical cohesion (Goodglass et al., 2001). Cohesion theory, which identifies core cohesion devices such as reference, conjunctions, ellipsis, substitution, and lexical cohesion, has been used to assess discourse impairments in aphasia (Halliday & Hasan, 1976). These devices serve as sensitive measures for detecting language deficits and distinguishing individuals with aphasia from those with typical language development (Strong & Shaver, 1991).

In the field of linguistics, numerous studies have examined lexical and grammatical cohesion devices in both written and spoken texts, yielding highly intriguing results. However, research specifically focusing on lexical and grammatical cohesion devices in individuals with Broca's aphasia and comparing them with typical individuals remains limited. Therefore, this study aims to compare the frequency and manner of using lexical and grammatical cohesion devices in individuals with Broca's aphasia and typical individuals to achieve a deeper understanding of the nature of language disorders in individuals with Broca's aphasia, their impact on speech production and comprehension, and ultimately to propose more effective strategies for language rehabilitation and addressing linguistic difficulties in these individuals.

The study of lexical and grammatical cohesion in individuals with Broca's aphasia not only contributes to a better understanding of linguistic mechanisms in the brain but also aids in the development of more effective rehabilitation programs. Since individuals with Broca's aphasia often struggle with producing complex sentences and using grammatical elements, a detailed examination of these impairments can help identify their strengths and weaknesses in language use. Furthermore, comparing these individuals with typical individuals can serve as a benchmark for assessing the severity of their impairment and progress in the rehabilitation process. Therefore, the aim of this research is to compare lexical and grammatical cohesion devices in individuals with Broca's aphasia and typical individuals and to answer the following questions:

1. Is there a significant difference in the use of lexical cohesion devices between individuals with Broca's aphasia and typical individuals?
2. Is there a significant difference in the use of grammatical cohesion devices between individuals with Broca's aphasia and typical individuals?
3. Is there a significant relationship between lexical and grammatical cohesion in individuals with Broca's aphasia?

2. Methods and Materials

This study aims to examine the qualitative and quantitative differences in the manner and extent of using cohesion devices between individuals with Broca's aphasia and typical individuals. To identify these differences, participants were categorized into two groups. The first group consisted of individuals diagnosed with Broca's aphasia by speech-language pathologists or neurologists. The second group comprised typical individuals whose absence of language impairment was confirmed through interviews. Since this study focuses on comparing two groups, it employs a comparative research design using a descriptive-analytical method.

To further assess language abilities and determine the severity of Broca's aphasia in participants, the Boston Aphasia Examination was administered. Additionally, a text cohesion test was conducted to evaluate the use of cohesion devices, including conjunctions, repetition, synonyms, reference, and other elements.

The statistical population of the first group included patients diagnosed with Broca's aphasia who were hospitalized at Tehran's Brain and Neurology Hospital. The second group consisted of typical individuals with no history of language impairment or Broca's aphasia. A purposive sampling method was used, selecting five participants in each group. The detailed characteristics of the samples are presented in Tables 1 and 2. The participants' educational levels ranged from high school diploma to a bachelor's degree, and their ages varied between 45 and 60 years. To control for the influence of demographic variables, the groups were matched in terms of age, gender, and educational level.

Data collection involved a speech production task, in which participants were asked to narrate a short story. Each participant's speech was individually recorded, transcribed using speech-to-text software, and converted into written form. Efforts were made to standardize the word count in the

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narrative texts to ensure that variations in word length did not affect the results. The texts were analyzed based on the frequency and percentage of lexical and grammatical cohesion devices, and the data were recorded in tables. For more detailed textual analysis, CLAN text analysis software was employed. To determine statistical significance between the two groups, the chi-square test was used.

Table 1

Characteristics of Individuals with Broca's Aphasia

No.	Patient Name	Type of Aphasia	Gender	Educational Level	Hand Dominance	Cause of Condition	Duration of Condition	Age	Native Language
1	S. B.	Broca	Male	Diploma	Right	Stroke	15 months	60	Persian
2	J. K.	Broca	Male	Diploma	Right	Stroke	20 months	58	Persian
3	M. Q.	Broca	Male	Associate	Right	Stroke	17 months	55	Persian
4	N. P.	Broca	Male	Bachelor's	Right	Stroke	15 months	40	Persian
5	H. S.	Broca	Male	Bachelor's	Right	Stroke	16 months	47	Persian

Table 2

Characteristics of Typical Individuals

No.	Participant Name	Physical Condition	Gender	Educational Level	Hand Dominance	Age	Native Language
1	M. Sh.	Healthy	Male	Diploma	Right	60	Persian
2	P. P.	Healthy	Male	Associate	Right	58	Persian
3	S. L.	Healthy	Male	Bachelor's	Right	55	Persian
4	S. K.	Healthy	Male	Diploma	Right	40	Persian
5	N. B.	Healthy	Male	Bachelor's	Right	47	Persian

In any scientific research, identifying and acknowledging limitations is crucial, as it enhances the understanding of the study's scope and the generalizability of its findings. Some potential limitations of this study include the small sample size of individuals with Broca's aphasia, as the disorder is relatively rare. Due to the difficulty in accessing individuals with Broca's aphasia, the sample size was limited to five participants, which may affect the statistical power and generalizability of the findings.

Additionally, individuals with Broca's aphasia may present with varying degrees of severity, which can make comparisons between groups more challenging. This variability needs to be controlled in the study. Another important consideration in such research is the influence of individual differences among participants, such as linguistic background, age, educational level, and cultural history, all of which significantly impact results. Therefore, controlling these factors is essential.

This study specifically focuses on individuals with Broca's aphasia, meaning the findings cannot be generalized to other types of aphasia.

3. Findings and Results

To examine the statistical significance of differences in the use of lexical and grammatical cohesion devices between individuals with Broca's aphasia and typical individuals—the primary research question of this study—the frequency distribution and percentage of different types of lexical and grammatical cohesion elements were first described. The obtained data and findings regarding cohesion devices in both groups are presented in Tables 3 and 4.

Table 3

Frequency and Percentage of Lexical Cohesion Devices in Typical Individuals

Cohesion Devices	Participant 1	%	Participant 2	%	Participant 3	%	Participant 4	%	Participant 5	%	Total
Repetition	31	22.07	34	22.4	30	20.13	32	22.02	29	19.46	156

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Discourse Markers	11	7.14	8	5.26	10	6.71	9	6.20	11	7.38	49
Antonymy	18	11.68	21	13.81	22	14.76	17	11.72	20	13.43	98
Reference	15	9.74	14	9.21	16	10.73	14	9.65	13	8.73	72
Collocation	21	13.63	17	11.18	16	10.73	15	10.34	16	10.74	85
Conjunctive Elements	15	9.74	14	9.21	14	9.39	12	8.27	14	9.40	69
Hyponymy	8	5.19	9	5.92	10	6.71	9	6.20	8	5.37	44
Synonymy	23	14.93	22	14.47	20	13.42	24	16.55	22	14.77	111
Ellipsis	12	7.79	11	7.23	11	7.38	13	8.96	13	8.73	60
Total	154	100	152	100	149	100	145	100	146	100	744

Table 4

Total Frequency and Percentage of Lexical Cohesion Devices in Typical Individuals

Repetition	Discourse Markers	Antonymy	Reference	Collocation	Conjunctive Elements	Hyponymy	Synonymy	Ellipsis	Total Frequency and Percentage
156	49	98	72	85	69	44	111	60	744
20.96%	6.59%	13.17%	9.68%	11.42%	9.27%	5.91%	14.92%	8.06%	100%

Table 5

Frequency and Percentage of Lexical Cohesion Devices in Individuals with Broca's Aphasia

Cohesion Devices	Participant 1	%	Participant 2	%	Participant 3	%	Participant 4	%	Participant 5	%	Total
Repetition	45	36.89	40	36.04	41	33.61	42	36.21	39	34.21	207
Discourse Markers	3	2.46	2	1.80	2	1.64	3	2.59	1	0.88	14
Antonymy	7	5.74	6	5.41	9	7.38	8	6.90	7	6.14	38
Reference	3	2.46	2	1.80	3	2.46	2	1.72	4	3.51	14
Collocation	5	4.10	4	3.60	6	4.92	5	4.31	4	3.51	24
Conjunctive Elements	1	0.82	2	1.80	3	2.46	1	0.86	2	1.75	9
Hyponymy	4	3.28	3	2.70	4	3.28	5	4.31	3	2.63	19
Synonymy	13	10.66	11	9.91	15	12.30	12	10.34	14	12.28	75
Ellipsis	42	34.43	41	36.94	39	30.97	38	32.76	40	35.09	200
Total	122	100	111	100	122	100	116	100	114	100	600

Table 6

Total Frequency and Percentage of Lexical Cohesion Devices in Individuals with Broca's Aphasia

Repetition	Discourse Markers	Antonymy	Reference	Collocation	Conjunctive Elements	Hyponymy	Synonymy	Ellipsis	Total Frequency and Percentage
207	14	38	14	24	9	19	75	200	744
34.50%	2.33%	6.33%	2.33%	4%	1.50%	3.17%	12.50%	33.33%	100%

Table 3 shows that the five typical participants used a total of 744 lexical cohesion devices in their storytelling. The most frequently used device was repetition, with 156 occurrences, while hyponymy was the least frequent, appearing only 44 times. The order of frequency of lexical cohesion devices in typical individuals from most to least was as follows: repetition (156),

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synonymy (111), antonymy (98), collocation (85), reference (72), conjunctive elements (69), ellipsis (60), discourse markers (49), and hyponymy (44).

Table 6 shows that the five individuals with Broca's aphasia used a total of 600 lexical cohesion devices in their storytelling. The most frequently used device was repetition, with 207 occurrences, while conjunctive elements were the least frequent, appearing only 9 times. The order of frequency in individuals with Broca's aphasia was as follows: repetition (207), ellipsis (200), synonymy (75), antonymy (38), collocation (24), hyponymy (19), reference (14), discourse markers (14), and conjunctive elements (9).

Analysis of Lexical and Grammatical Cohesion Devices in Typical Individuals

The analysis of the data presented in Table 3 illustrates the distribution and frequency of various lexical and grammatical cohesion devices in the texts produced by typical individuals. These data include repetition, discourse markers, antonymy, reference, collocation, conjunctive elements, hyponymy, synonymy, and ellipsis. The following section provides an analysis of these findings.

Repetition: Repetition, with 156 occurrences, had the highest frequency among the examined elements. The distribution of repetition in the texts of typical individuals was relatively balanced, with Participant 2 (22.4%) and Participant 4 (22.02%) demonstrating the highest frequency, while Participant 5 (19.46%) exhibited the lowest.

Discourse Markers: Discourse markers, with 49 occurrences, had the lowest frequency among the examined elements. Their distribution in the texts of typical individuals was relatively uniform, although Participant 1 (7.14%) and Participant 5 (7.38%) used them slightly more than the others.

Antonymy: Antonymy, with 98 occurrences, was one of the commonly used elements in the texts. This indicates a tendency to create contrast and differentiation between concepts to capture the audience's attention. The highest frequency of antonymy was observed in Participant 3 (14.76%), while the lowest was found in Participant 4 (11.72%).

Reference: Reference, with 72 occurrences, indicated a balanced use of this device in the texts. Reference is typically used to establish connections between different parts of the text or to refer to previous concepts. Its distribution was relatively uniform across typical individuals, with Participant 3 (10.73%) exhibiting slightly higher usage.

Collocation: Collocation, with 85 occurrences, demonstrated a relatively high frequency of use in the texts. Collocation is commonly used to create coherence and cohesion between words and phrases. The highest frequency was observed in Participant 1 (13.63%) and Participant 5 (10.74%), while the lowest was in Participant 4 (10.34%).

Conjunctive Elements: Conjunctive elements, with 69 occurrences, showed a balanced distribution in the texts. These elements are typically used to establish connections between sentences and paragraphs. Their distribution was relatively even among typical individuals, with Participant 1 (9.74%) and Participant 5 (9.40%) showing slightly higher usage.

Hyponymy: Hyponymy, with 44 occurrences, had the lowest frequency among the examined elements. Its distribution in the texts of typical individuals was relatively uniform, with a slightly higher occurrence in Participant 3 (6.71%).

Synonymy: Synonymy, with 111 occurrences, was one of the frequently used elements in the texts. This indicates a preference for using synonymous words and phrases to enhance linguistic diversity and richness. The highest frequency of synonymy was found in Participant 4 (16.55%) and Participant 1 (14.93%), while the lowest was in Participant 3 (13.42%).

Ellipsis: Ellipsis, with 60 occurrences, showed a balanced distribution in the texts. Ellipsis is typically used to avoid unnecessary repetition and to achieve textual conciseness. The highest frequency was observed in Participant 4 (8.96%) and Participant 5 (8.73%), while the lowest was in Participants 2 and 3 (7.23%).

Analysis of Lexical and Grammatical Cohesion Devices in Individuals with Broca's Aphasia

The analysis of the data presented in

Table 4 illustrates the distribution and frequency of various lexical and grammatical cohesion devices in the texts produced by individuals with Broca's aphasia. These data include repetition, discourse markers, antonymy, reference, collocation, conjunctive elements, hyponymy, synonymy, and ellipsis. The following section provides an analysis of these findings.

Repetition: Repetition, with 207 occurrences, had the highest frequency among the examined elements. The distribution of repetition in the texts of individuals with Broca's aphasia was relatively balanced, with Participant 1 (36.89%) and Participant 4 (36.21%) exhibiting the highest frequency, while Participant 5 (34.21%) showed the lowest.

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Discourse Markers: Discourse markers, with 14 occurrences, had the lowest frequency among the examined elements. Their distribution in the texts of individuals with Broca's aphasia was very limited, although Participant 1 (2.46%) and Participant 4 (2.59%) used them slightly more than the others.

Antonymy: Antonymy, with 38 occurrences, was one of the less frequently used elements in the texts. This indicates a lack of inclination to create contrast and differentiation between concepts. The highest frequency of antonymy was found in Participant 3 (7.38%) and Participant 4 (6.90%), while the lowest was in Participant 1 (5.74%).

Reference: Reference, with 14 occurrences, demonstrated very limited usage in the texts. Reference is typically used to establish connections between different parts of the text or to refer to previous concepts. Its distribution in the texts of individuals with Broca's aphasia was minimal, although Participant 5 (3.51%) showed slightly higher usage.

Collocation: Collocation, with 24 occurrences, indicated relatively low usage in the texts. Collocation is typically used to establish coherence and cohesion between words and phrases. The highest frequency was observed in Participant 3 (4.93%) and Participant 1 (4.10%), while the lowest was in Participants 2 and 4 (3.60%).

Conjunctive Elements: Conjunctive elements, with 9 occurrences, had the lowest frequency in the texts of individuals with Broca's aphasia. Their distribution in these texts was very limited, although Participant 3 (2.46%) and Participant 5 (1.75%) showed slightly higher usage.

Hyponymy: Hyponymy, with 19 occurrences, demonstrated relatively low usage in the texts. This device is typically used to establish semantic relationships between concepts. The highest frequency of hyponymy was observed in Participant 4 (4.31%) and Participant 1 (3.28%).

Synonymy: Synonymy, with 75 occurrences, was one of the frequently used elements in the texts. This indicates a preference for using synonymous words and phrases to enhance linguistic diversity and richness. The highest frequency of synonymy was found in Participant 4 (16.55%) and Participant 1 (14.93%), while the lowest was in Participant 3 (13.42%).

Ellipsis: Ellipsis, with 200 occurrences, was the second most frequently used element in the texts. Ellipsis is typically used to avoid unnecessary repetition and to achieve textual conciseness. The highest frequency was observed in Participant 2 (36.94%) and Participant 5 (35.09%), while the lowest was in Participant 4 (32.76%).

Table 7

Chi-Square Test Results for Lexical and Grammatical Cohesion Devices

Cohesion Device	Typical Individuals (Frequency)	Individuals with Broca's Aphasia (Frequency)	Chi-Square (χ^2)	p-value	Result
Repetition	156	207	14.12	0.0002	Significant
Discourse Markers	49	14	9.67	0.0019	Significant
Antonymy	98	38	26.47	<0.0001	Significant
Reference	72	14	38.84	<0.0001	Significant
Collocation	85	24	45.12	<0.0001	Significant
Conjunctive Elements	69	9	61.54	<0.0001	Significant
Hyponymy	44	19	12.34	0.0004	Significant
Synonymy	111	75	13.94	0.0002	Significant
Ellipsis	60	200	98.46	<0.0001	Significant

There is a statistically significant difference between the two groups in all lexical and grammatical cohesion devices (p-value < 0.05).

Typical individuals used more complex cohesion devices such as reference, conjunctive elements, and hyponymy significantly more frequently. Individuals with Broca's aphasia relied significantly more on simpler cohesion devices such as repetition and ellipsis.

4. Discussion and Conclusion

The results of this study indicate significant differences in the use of lexical and grammatical cohesion devices between individuals with Broca's aphasia and typical individuals. The analysis revealed that individuals with Broca's aphasia relied heavily on simpler cohesion devices such as repetition and ellipsis, while typical individuals exhibited a more balanced use of complex cohesion devices,

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including reference, conjunctions, and hyponymy. The chi-square test results confirmed that these differences were statistically significant ($p < 0.05$) across all cohesion devices. These findings align with previous studies emphasizing the linguistic impairments associated with Broca's aphasia, particularly in sentence construction and lexical access (Thompson, 2001; Thompson & Shapiro, 2007).

One of the key findings of this study is the excessive reliance on repetition among individuals with Broca's aphasia, which accounted for 34.50% of all cohesion devices used by this group, compared to 20.96% in typical individuals. This pattern supports the work of Kagan et al. (2007) and Priestley et al. (2012), who found that individuals with Broca's aphasia use a more restricted vocabulary and tend to repeat words due to difficulties in lexical retrieval. Since Broca's aphasia affects the frontal lobe, which plays a crucial role in planning and organizing speech, affected individuals often experience difficulty in selecting alternative words, resulting in frequent repetition. This compensatory mechanism allows them to maintain some level of communication despite severe lexical limitations.

Similarly, ellipsis was the second most frequently used cohesion device in individuals with Broca's aphasia (33.33%), significantly higher than in typical individuals (8.06%). The increased reliance on ellipsis can be attributed to grammatical deficits, as Broca's aphasia is characterized by agrammatism, making it difficult for individuals to construct grammatically complete sentences (Bear et al., 2020; Purves et al., 2018). These findings are consistent with the study by Goodglass, Kaplan, and Barresi (2001), which reported that Broca's aphasia patients often omit auxiliary verbs, prepositions, and articles, leading to fragmented and telegraphic speech (Goodglass et al., 2001). The preference for ellipsis over other grammatical cohesion devices suggests that individuals with Broca's aphasia tend to simplify their speech by omitting function words rather than integrating them into cohesive structures.

Conversely, the findings demonstrated that typical individuals exhibited significantly higher usage of complex cohesion devices such as reference, conjunctions, and hyponymy. Reference, which is essential for maintaining coherence in discourse, was used significantly more by typical individuals (9.68%) than by individuals with Broca's aphasia (2.33%). The limited use of reference among individuals with Broca's aphasia aligns with previous research by Yousefian et al. (2014), who found that individuals with right-hemisphere stroke impairments also exhibited deficits in using reference markers, leading to difficulties in establishing coherence in speech. This suggests that individuals with Broca's aphasia may struggle with integrating information across sentences due to impaired syntactic processing.

Similarly, conjunctive elements, which facilitate logical connections between clauses, were used significantly less by individuals with Broca's aphasia (1.50%) compared to typical individuals (9.27%). This finding supports the work of Halliday and Hasan (1976), who identified conjunctions as critical for discourse coherence (Halliday & Hasan, 1976). The significant reduction in conjunction use among individuals with Broca's aphasia indicates that their speech lacks syntactic complexity, as they tend to produce short, isolated sentences rather than integrating ideas into coherent discourse (Priestley, 2012). This finding is further reinforced by the work of Brent, Michan, and Handiges (1996), who highlighted the difficulties individuals with aphasia face in processing complex sentence structures, particularly those involving subordination and coordination (Berndt et al., 1996).

Another notable finding is the significantly lower use of hyponymy among individuals with Broca's aphasia (3.17%) compared to typical individuals (5.91%). Hyponymy involves the use of specific terms that relate to broader categorical concepts, requiring a higher level of lexical precision. The reduced use of hyponymy in individuals with Broca's aphasia suggests difficulties in retrieving and categorizing words, which has been previously observed in studies on lexical access deficits in aphasia (Kiran & Thompson, 2003). The inability to use hierarchical word relationships effectively further contributes to the lexical simplification observed in their speech.

Furthermore, the study found that individuals with Broca's aphasia exhibited significantly lower usage of synonymy (12.50%) compared to typical individuals (14.92%). The preference for using the same words rather than employing synonyms may be due to difficulties in lexical retrieval and word substitution, as described in the prior studies (Kagan, 2007; Priestley, 2012). The findings also align with the work of Arianpour (2007), who found that individuals with Broca's aphasia struggle with accessing a diverse vocabulary and rely on high-frequency words rather than employing more complex lexical alternatives (Arianpour, 2007).

The study's findings provide further evidence that grammatical cohesion is more impaired than lexical cohesion in individuals with Broca's aphasia. The

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significantly lower use of conjunctions, reference markers, and grammatical function words is indicative of agrammatism, a hallmark feature of Broca's aphasia (Thompson, 2001). This aligns with research by Goodglass, Kaplan, and Barresi (2001), who reported that individuals with Broca's aphasia produce grammatically incomplete sentences due to their impaired syntactic processing (Goodglass et al., 2001). The omission of grammatical cohesion devices significantly affects discourse coherence, making it challenging for listeners to follow the intended message.

Overall, the study's findings highlight the specific linguistic deficits associated with Broca's aphasia and provide insights into the nature of discourse cohesion impairments in affected individuals. The results align with the broader body of research indicating that Broca's aphasia primarily impacts grammatical cohesion, while lexical cohesion is relatively preserved but simplified (Thompson, 2001; Thompson & Shapiro, 2007; Yousefian, 2014; Yule, 2020). By identifying the specific cohesion deficits in individuals with Broca's aphasia, this study contributes to a deeper understanding of the disorder and provides a basis for developing targeted rehabilitation strategies to improve discourse coherence in affected individuals.

Despite its contributions, this study has several limitations. First, the sample size was relatively small, consisting of only five participants in each group. This limits the generalizability of the findings to broader populations with Broca's aphasia. Future studies should include larger and more diverse samples to enhance the reliability of the results. Second, the severity of Broca's aphasia varied among participants, which may have influenced the cohesion patterns observed. Although efforts were made to control for demographic variables such as age and education, individual differences in cognitive abilities and language proficiency may have affected the results. Finally, the study focused solely on spoken discourse, whereas written language abilities were not examined. Since written language often involves different cohesion strategies, future research should explore cohesion patterns in both spoken and written modalities.

Future research should expand the investigation of cohesion devices in individuals with different types of aphasia to determine whether similar patterns exist across other aphasic syndromes. Additionally, longitudinal studies examining changes in cohesion over time following language therapy would provide valuable insights into the effectiveness of rehabilitation interventions. Future studies could also employ neuroimaging techniques to explore the neural correlates of cohesion deficits in individuals with Broca's aphasia. Understanding the neural mechanisms underlying cohesion impairments could contribute to more targeted interventions. Finally, cross-linguistic studies could examine whether cohesion deficits in Broca's aphasia manifest similarly in languages with different syntactic structures, providing a more comprehensive understanding of language processing in aphasia.

The findings of this study have important implications for speech-language therapy. Clinicians should prioritize interventions that target the use of complex cohesion devices, such as conjunctions, reference markers, and hyponymy, to improve discourse coherence in individuals with Broca's aphasia. Therapy should focus on increasing syntactic complexity through structured sentence-building exercises that incorporate function words and grammatical morphemes. Additionally, lexical retrieval training should emphasize expanding vocabulary diversity by encouraging the use of synonyms and antonyms. Given the reliance on repetition and ellipsis among individuals with Broca's aphasia, therapy should aim to introduce alternative lexical choices and sentence structures to reduce excessive word repetition. Finally, incorporating discourse-based therapy that involves storytelling and narrative production can help individuals with Broca's aphasia practice cohesion strategies in naturalistic speech contexts, ultimately enhancing their communicative effectiveness in daily interactions.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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