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Language Rehabilitation In Severe Hemorrhagic Stroke. Applying A Cognitive Neuropsychological Approach

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ABSTRACT

This is a case study of a 31-year-old patient with a language disorder secondary to a hemorrhagic stroke determined by an initial evaluation through aphasic disorders battery, to whom an intervention program based on the cognitive neuropsychological approach was implemented in 131 therapeutic sessions divided into five phases of the praxic orofacial systems rehabilitation, and articulatory production, and thought-word representation, and listening comprehension, and reading-writing. The reassessment results indicated significant changes in phonetic characteristics, verbal fluency, processing of auditory information, and oral and written discourse organization. It is concluded that the intervention program implementation allowed favoring the patient's language process for her communication in the family and social context.

Keywords: language disorder, cerebrovascular accident, cerebral hemorrhage, language evaluation, rehabilitation program

1. INTRODUCTION

Cerebrovascular accident- CVA is a sudden disorder of the decrease in the flow of cerebral blood circulation due to obstruction by a thrombus or embolus in 85% of cases. It prevents irrigation and blood supply in the cortical areas and subcortical, or by hemorrhage in 15%, as a result of an encephalic blood vessel rupture with blood extravasation outside the vascular flow, which causes tissue death due to lack of access to oxygen and other components transmitted by blood. (León, 2016), consequently owing to different determining predisposing factors such as arterial hypertension, hyperlipidemia, diabetes mellitus, cardiovascular diseases, smoking, age, genetics, sex, obesity, and physical inactivity. It establishes an entity with heterogeneous and multifactorial characteristics (García et al. al, 2019); its clinical development generates a disturbance in brain function lasting more than 24 hours, and its consequences will depend on the location and lesion size. (MinSalud, 2015, as cited in Pineda and Tolosa, 2022). According to the World Health Organization-WHO, stroke represents the second cause of death and the first cause of disability in adults. Worldwide, 15 million people suffer a stroke per year, of which 6.5 million die, and 30% with a permanent disability (WHO, 2021).

According to the epidemiological data investigation of stroke in the last 10 years, it is established that there is a heterogeneous incidence among countries in the world. It indicates a crude average rate of 149.5 cases per 100,000 inhabitants for vascular brain disease, 155 ischemic strokes, 29 hemorrhagic strokes, and 6.5 subarachnoid hemorrhages, reflecting a worldwide trend of decrease in geographical areas of the Asian continent, but with a worrying trend of increase in the American continent. (Purroy & Montalá, 2021). In most Latin American countries, stroke occupies the second cause of mortality with 37.3 cases per 100,000 inhabitants (PAHO, 2021). In the particular case of Colombia, it is located in the first five mortality causes in the country- It causes 32 deaths per 100,000 inhabitants in the year and is the first cause of disability in 30% to 40% of the people who survive a brain attack. (Ministry of Health, 2021).

However, the scientific evidence systematic review determines that people who suffer from some type of stroke may present long-term vascular lesions that produce cognitive and/or sensorimotor deficits of varying complexity according to the territory-specific characteristics in which a neuronal death has occurred (Oliveira, 2016), and the stroke type are more affected than compared to ischemic patients. In hemorrhagic patients case the cognitive memory domains, attention, executive function, visuospatial reasoning, and language (Bayona, 2010, Rodríguez and Rodríguez, 2015, Oliveira, 2016). Likewise, associated disorders of depression, anxiety, apathy, irritability, and psychotic disorders. (Godefroy 2003 as cited in Moreno, 2017).

At the language function level, impairment can occur with linguistic errors in the expressive and/or comprehensive dimensions or, in the most complex case, a total or partial loss of the processes involved in language (Helm & Albert, 2005). It results due to cerebral dysfunction in the neuronal network distributed in cortical and left cerebral hemisphere subcortical structures, and in the areas responsible for spontaneous language tasks, listening comprehension, repetition, naming, reading, writing and calculation (Berthier et al, 2011). In this particular case, hemorrhagic strokes show a greater decrease in language skills determined by a symptomatological profile of the anomias language, verbal disfluency, echolalias, alterations in reading and writing, and mathematical calculation. (Argüello and Palacios, 2015).

The recovery process from language disorders secondary to stroke sequelae requires a comprehensive evaluation process that begins with a clinical history systematic review and the application of standardized and/or qualitative methods through which the communicative linguistic characteristics are established. It allows a classification of the clinical picture according to the aphasic typology. (Jimenez, 2011). The speech therapy intervention continues, in which neuroscientific evidence indicates variables related existence to rehabilitation and time recovery, intensity, amount of treatment, and the patient's neural conditions. Added to this, are the acquisition criteria, generalization, maintenance, interference, and the effects of neurobiology that support cognitive-linguistic behaviors. (Hernández and Uribe, 2011).

Consequently, the communication deficits study supports inquiring into the foundation for language intervention. It reflects the explanatory theories' development of the functions interfered with by brain damage sequelae, trying to reconcile the structures from the localizationist doctrine, and for the most part, it considers plasticity as a recovery substrate. In general, the theoretical supports

oscillate between the restoration, reorganization, and replacement of lost functions. (Luria 1977, as cited in Ginarte, 2002). Thus, in recent decades speech therapy intervention is based on scientific evidence allowing the application of different procedures, approaches, techniques, and individual and/or group treatment programs according to the typology of aphasia based on semiology (Helm & Albert, 2005, Ardilla, 2006, IRM, 2011, and Jiménez, 2011), and in the theoretical bases that support rehabilitation therapies from stimulation-facilitation, cognitive neuropsychological approaches and functional communication (Horner et al., 1994 as cited in Villodre & Morant, 2011).

This is how speech and language pathologists have currently chosen to base speech therapy intervention with comprehensive approaches due to the pace at which the various theoretical positions and language acquisition arguments have been changing (Álvarez and Bermúdez, 2008 Jiménez, 2011). It suggests the rehabilitation approach based on single case studies, to monitor each patient's evolution, and the different particular characteristics, which indicates an individualized and continuous therapy (Greneer et al., 2007). Therefore, language therapy has been implemented with a solid scientific foundation and with the potential for creativity. It takes into consideration the cognitive neuropsychological mechanisms of brain recovery after an injury, and also it allows a clear understanding of current rehabilitation developments panorama, and understanding of the brain organization related to language, facilitating the new therapeutic alternatives development (Hernández and Uribe, 2011). In addition, the use of information and communication technologies from cognitive aspects. (Cortes and Álvarez 2014, Berthier et al., 2014), its effectiveness has influenced the knowledge and clinical practice of speech therapy professionals. (Hernández and Uribe. 2011, p.64).

Given the above scenario, the relevance, and importance of describing a case study on a speech therapy intervention program implementation in a patient with a language disorder due to a hemorrhagic stroke. It is aimed at promoting the linguistic process through the specific rehabilitation strategies application based on the cognitive neuropsychological approach for information processing in order to contribute to a functional communication of the patient. This is how the impact of the case study is highlighted. It will allow generating knowledge for care guides elaboration for central origin language disorders intervention. It will contribute to the rehabilitation processes foundation in the language area in adults for speech therapy professionals with its dissemination to the academic, and scientific community at a national and international level.

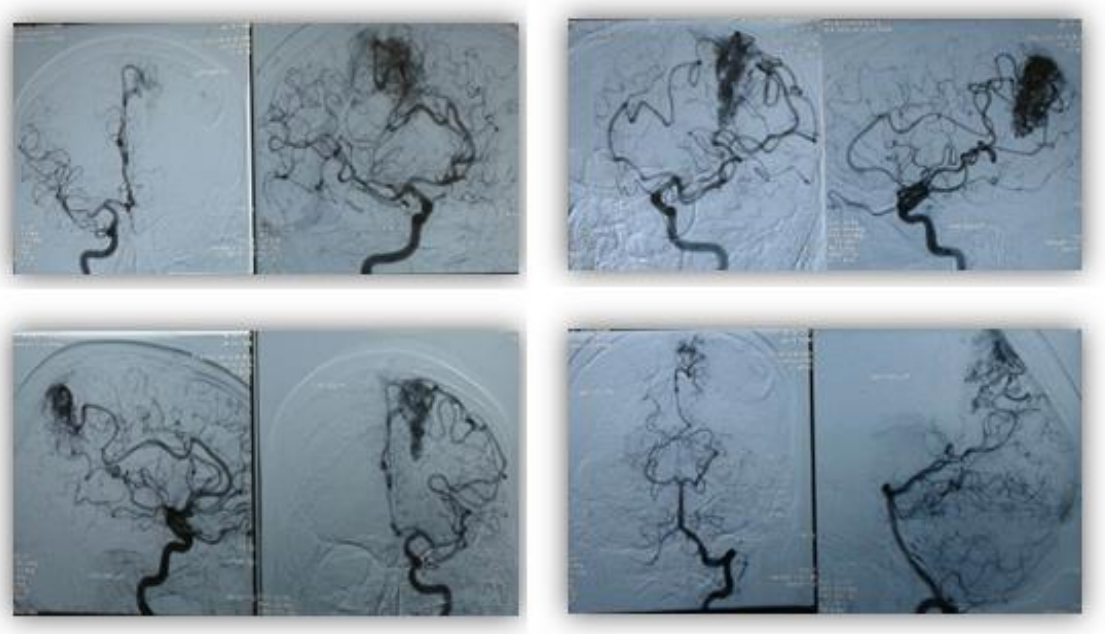
2. MATERIALS AND METHODS

2.1 Participant

This is an E.J.C.M male patient, 31 years old, single, right-handed, with a bachelor's degree and occupation as a bricklayer, with a history of predisposing factors for constant headaches without medical attention and alcoholic beverages consumption; He presented a left parieto-occipital intraparenchymal cerebral hemorrhage due to a left parietal arteriovenous malformation with afferents from the posterior parietal branches of the middle central artery and drainage to the sagittal branch that caused an intracranial hypertension syndrome. Likewise, a loss in the posterior angle in the brain parenchyma at the frontal and parietal region level on the left side with exvacuous

dilatation of the lateral ventricle on the same side, with multiple metallic artifacts with volume loss in the adjacent brain parenchyma. After a two-month stay in the intensive care unit of the Bocagrande "Crecer" Clinic in Cartagena - Colombia with postoperative intraparenchymal cerebral hematoma drainage, severe hemorrhagic stroke, convulsive syndrome, neurological deterioration due to global aphasia and motor involvement due to quadriparesis. It is managed by the services of neurology, internal medicine, and interdisciplinary rehabilitation therapies.

Figure 1: Cerebral angiogram of the patient E.J.C.M



2.2 Procedure

For the person's participation, an interview was conducted with the parents and the subject to be investigated to explain the case study characteristics and guarantee their collaboration with the voluntary signing of the informed consent in accordance with the ethical regulation in research with human beings in Colombia determined by resolution 008430 of the Ministry of Health (1993) that establishes the scientific, technical and administrative standards; and at the international level the ethical principles of the Helsinky Declaration (2013).

In the initial evaluation process, the patient's language process evaluative technique was used through the application of the anamnesis protocol for Goodglass's aphasia diagnosis (2006). It allowed characterizing the personal, family, academic history, employment, language skills and communication skills, language background, medical history, diagnosis, and medical and interdisciplinary treatments. Likewise, in an analytical and functional direction, the battery for aphasic disorders-BETA evaluation of Cuetos and González (2009) was applied. It concedes the language exploration in oral and written modalities. It is made up of thirty tasks grouped into six blocks of five tests in each segment. However, for investigation purposes, the tasks were grouped taking into consideration the compressive components, as well as the expressive and reading-

writing language ones. For the performance interpretation, the components were analyzed through three different indices' types of development results in the task execution, as well as the variables that influence specific errors type. In order to diagnose the patient's communicative disorder, it was considered the application rules, correction, statistical foundation interpretation, and scale to determine the specific's performance degree of each test with a scores synthesis establishing lower scores for not reaching the expected performance determining a disorder criterion and when they reach high-performance normality allowing descriptive interpretation of the linguistic performance of the subject.

3. RESULTS OF THE EVALUATION

Table 1 describes the results of the initial language evaluation using the BETA battery, in which an incipient ability to recognize speech sounds (5/32) and identify pseudowords and words with traits were evidenced at a comprehensive auditory level equal and different (4/32). It establishes semantic relationships of spoken word-drawing pairing, semantic association, object-action association, word definition pairing, and synonym pairing and It points out the different (3/30) points respectively, with the linguistic errors presence of semantic paraphasias, anomies, and neologisms.

Regarding expression, difficulties were found in naming semantic categories and words that begin with a certain sound (2 /+15); fluent speech absence to name people's names (1/ +5), and narrative in the description of the plates (0/ +5); incipient ability to reproduce words and pseudowords (2/30) correspondingly. In addition, difficulties in naming objects-actions and establishing definitions, obtaining (2/30) respectively with linguistic errors of phonemic paraphasias, anomies, and in certain episodes' selective mutism before some tasks and syntactic agrammatism.

In the reading-writing language, difficulties were determined in the reading mechanism established by an incipient ability to name letters (1/20), visual lexical decision (2/30), reading of words and pseudowords (0/32), pairing written sentence-drawing (0/30) and spoken sentence-drawing (0/30), and establishing judgments of grammaticality (0/40), with alexia associated symptoms presence. Similarly, an inability to point to letters (0/20), uppercase-to-lowercase copying (0/8), written naming of objects (0/10), words dictation with arbitrary spelling (0/10), pseudowords (0/10), and written names of objects (0/9) with the presence of agraphia and syntactic agrammatism due to manual praxis compromise caused by quadriparesis.

Table 1: Results of the initial language assessment using the assessment battery for Aphasic-BETA disorders

UNDERSTANDING LANGUAGE			
TASKS	**SCORE**	**NORMAL**	**DISORDER**
Phoneme discrimination	5	29- 32	0-28
Lexical-auditory decision	7	29- 32	0-28
Spoken word- drawing pairing	3	28- 30	0-27

Semantic association	3	28- 30	0-27
Object-action association	3	27- 30	0-26
Definition- word pairing	3	27- 30	0-26
Synonym matching	3	25- 30	0-24
Point out the different	3	24- 30	0-23
EXPRESSIVE LANGUAGE			
Semantic and phonological verbal fluency	2	+15	0-14
Verbal fluency of personal names	1	+5	0-4
Sheet description	0	+3	0-2
Repetition of words	2	31-32	0-30
Pseudoword repetition	2	24-30	0-23
Naming of objects	2	23- 30	0-22
Denomination of shares	2	20- 30	0-19
Naming definitions	2	22- 30	0-21
READ-WRITTEN LANGUAGE			
Letter naming	1	19-20	0-18
Visual lexical decision	2	30-32	0-29
Word reading	0	31-32	0-30
Pseudoword reading	0	26-30	0-25
Spoken sentence pairing- drawing	0	28-30	0-27
Matching written sentence – drawing	0	29-30	0-28
Grammaticality judgments	0	31-40	0-30
Point to the letter	2	19-20	0-18
Copy from uppercase to lowercase	0	7-8	0-6
Arbitrary Spelling Word Dictation	0	7-10	0-6
Pseudoword dictation	0	7-10	0-6
Written names of objects	0	9- 10	0-8

According to the initial evaluation results, an oral diagnosis of comprehension and reading-written language disorder secondary to severe hemorrhagic stroke characterized by poor oral production skills, verbal fluency, conversational speech/exposure, repetition, naming, listening comprehension, and reading-writing

4. AUDIOLOGICAL INTERVENTION PROGRAM

The speech-language intervention program design was executed based on the intervention scientific evidence systematic review approach based on the linguistic processing of Patterson and Sheweell (1987). It highlights the postulates of Cuetos (1998) for the treatment of disorders aphasic individually, based on the results of the evaluation. Likewise, it proposes working on the aphasia treatment from the cognitive neuropsychological model, visualizing the patient as a human being

who has impaired certain language functions. In which the therapist assumes the role of instructor, teacher, psychologist, and friend. This is to achieve a good recovery and formalize his teachings in therapeutic strategies that overcome understanding, expression, articulation, phonation, and listening difficulties. (Cuetos, 1998 as cited in Pausy et al., 2013). In addition, information processing models for specific functions were studied, especially the motor actor, according to the systematic review carried out by Beneted (2002).

In the same way, an analysis of the patient's own characteristics was executed. Systematically it takes advantage of the channels processes reorganization levels and restoration of the linguistic functions lost in the six months after the brain damage. Since it is the indicated time in which a spontaneous recovery is a maximum tissue repair peak and the manifestation of the sequelae in the language. (Ardila, 2006., and González and González, 2012). This is how **131** intervention sessions of 1 hour each were developed with an intensity of three times a week for twelve months organized and structured in five phases of intervention.

In **phase 1**, the **orofacial praxis system and articulatory production** were approached from the information processing components' point of view that was preserved and/or damaged in the patient. The intervention was developed in **29** therapeutic sessions aimed at activating the motor apparatus and learning, voluntary and purposeful articulatory patterns in accordance with the approaches of González and Heilman (1997). From the conditions for the execution of the movements by imitation involving the system perceptual-visual; under order the language and thought that allows the understanding and also the spontaneous space-time sequencing of the motor act. Likewise, emphasis was placed on the applicability of the oro-motor exercises the compression-production conjugation of the motor act and articulation according to the explanatory model of Signoret and Nort (1979), and the comprehension-production processing of the language of González et al., 1991. In addition, the mechanisms criteria, and procedures involved in gestural engrams, spatio-motor processes for the imitation and execution of intransitive and automated gestures were considered (Buxbaum and Coslett, 1998 as cited in Rap, 2001).

In **phase 2**, the **word representation system** was worked on for the processing and language transmission through verbal expression, in which the message implies the representations of thought for articulatory production through the praxic system that requires the previous motor program activation to direct the articulatory movements to the phonatory apparatus. It produces a physical response that constitutes the language code support. (Benedet, 2002). **Twenty-four** intervention sessions were developed for access to the lexicon through the stores of phonological lexicon word representations and for the expression and comprehension reviewed by Hillis, 1993 as cited in Rap, 2001. Likewise, the semantic lexical store contains preconscious and pre-conceptual representations' immediate meanings of the conceptual system words independently proposed by Nickels, 1995 as cited in Rap, 2001 in perceptual-gnostic functions consideration.

In **phase 3**, the **listening comprehension system** of simple and complex words and grammatical sentences was treated in **25** therapeutic sessions with the purpose of activating the phonological, semantic, and orthographic word representation, and in general, the cognitive system contact to establish the word meaning in its global, conceptual and cognitive context. (Benedet, 2002). For the

understanding of words, the approach was based on the explanatory model of Caplan (1992) in reference to the acoustic-phonematic conversion process of physical signals to a mental language representation that has particular sonority characteristics and articulation mode that the result corresponds to a phonemes sequence that enters the SPL to be able to determine that the word representation is new and/or old must access the phonological lexicon and for the basic meaning recognition to the semantic lexicon. In addition, the approaches of Allen et al., 2003, were taken into account, in reference to the grammatical rules for oral recognition and production, the orthographic lexicon storage for the inflectional activation, or derivative morphology. For grammatical sentence comprehension, the intervention was required under the implication of word processing that constitutes the grammatical structure, the thematic roles assignment through syntactic rules, and access to the meaning or propositional content of the sentence through pathways. It simplified and pragmatic syntax. (Benedet et al., 1998). Likewise, the grammatical processing activation of sentences through semantic participation and syntactic systems was established. (Martin, 2010).

In **phase 4**, **the oral production system** of simple and complex words, grammatical sentences, and oral discourse was strengthened through **27** therapeutic intervention sessions aimed at activating the thought system, language representations, and the oromotor praxic system for the articulated oral discourse production. For the production process of simple and complex words, the conceptual system must be activated in which the representation of the language in the SPL and the semantic lexicon participate in accordance with the definitions by use, function, and physical characteristics to establish a meaning representation when contacted with the phonological lexicon for the phoneme sequences planning of the word to access articulatory production. (Benedet, 2002). In this sense, the repetition process and the word naming were worked on activating the process syllable by syllable, achieving the necessary motor plan for its articulation; and on the same line word by word for the pronunciation of simple and complex sentences. (Levelt, 1989). Likewise, the language comprehension process was treated in parallel when accessing the semantic representation that specifies the syntactic and diacritical word properties for the syntactic structure planning of the sentence. (Levelt, et al., 1999, and Caramazza and Hillis, 1990).

In **phase 5**, the **reading-writing system** was attended through the execution of **26** sessions in order to achieve the activation of the lexical and sublexical pathways combination supported by the neuropsychology theoretical foundation for the words reading-writing with minimum errors of correspondence between graphemes and phonemes. (Rapp et al., 2002). In the first instance, the **reading process** was activated in the oral, silent, and comprehensive modalities through the sublexical route that implies a verbal stimulus visual analysis. The graphemes conversion sequence into phonemes chains through the phoneme-grapheme relationship mechanism. The planning for oral production and its maintenance in the phonological retainer for the articulatory plan activation for syllables reading, pseudowords, and regular and irregular words silently or aloud. Likewise, support was given to the reading process through the access path to the phonological-graphematic lexicon. (Rapp et al., 2002, and Benedet, 2002). Subsequently, the **writing system** was worked on in the copy, dictation, and semantic-grammatical modalities, activating the acoustic-phonological word analysis and its segmentation into sublexical units for the conversion of the phonemic-

graphemic unit for the letters abstract sequencing. The graphematic stop gives way to the planning and execution of the graphic motor plan. (Rapp et al., 2002). In the same sense, the writing process was strengthened with the phonological form support of the word in the phonological lexicon for comprehension and the graphic aspect in the graphemic lexicon for written production.

Table 2: Intervention Phases of Language Systems and Therapeutic Strategies

INTERVENTION PHASES	SYSTEMS	STRATEGIES
Phase 1 **Praxic orofacial system and articulatory production.**	Activation of the orofacial motor apparatus and articulatory pattern.	- Praxic orofacial bilabial, lingual, mandibular and velar exercises by imitation, order and spontaneous. -Exercises of repetition, automation, systematization and generalization with bilabial, alveolar, velar, fricative, vibrative and symphonic phonemes.
Phase 2 **Word representation system.**	Activation of the phonological and semantic lexical store.	-Perceptual-gnostic exercises for the recognition and identification of verbal information. -Processing and transformation exercises of the word representation and access to the phonological lexicon. -Exercises of word representation with perceptual-gnostic support and oral production.
Phase 3 **Listening comprehension system.**	Activation of the phonological, lexical and orthographic store	- -Exercises of phoneme discrimination, auditory lexical decision, word-image pairing, and forced choice judgment of pseudo-words and words. - Recognition exercises of radicals- affixes, lexical decision of simple words-morphologically complex, and combinations of syntactic category with the words meaning. -Exercises of lexical recognition and comprehension, meaning of words and pragmatic processing of simple sentences. -Exercises of recognition and morphological comprehension, word's syntactic category and syntactic processing of complex sentences.

		- Semantic relations exercises of antonymy, synonymy and analogies.
Phase 4 **Oral production system.**	Activation of the representation of thought, word and articulatory motor plan	- Exercises of access to the semantic, phonological and orthographic lexicon. -Identification exercises of homophone images. -Oral naming exercise of images. -Comprehension exercises of content words and with linked morphemes. - Oral production exercises of simple words. -Exercises on syntactic categories' oral production of content words, phonological form of lexemes, bound and free morphemes. -Exercises on oral production of morphologically complex word forms. - Oral production exercises of simple and complex syntactic structure constructions. - Oral exercises production of sentences plots structures. -Exercise reorganization of the verb tense in simple and multi-causal subclausal emissions. - Reorganization exercises of syntactic structures according to the agreement of gender and number. - Oral production exercises of basic needs expressions. -Exercises of oral expression, verbal and non-verbal agility. -Exercises to restore the melodic and rhythmic component of language. -Exercises of social responses, narrative discourse and spontaneous language.
Phase 5 **Reading-writing system**	Activation of the sublexical and lexical route.	- Grapheme-phoneme relationship exercises. -Exercises of phonemic sequences. -Access exercises to the phonological-graphematic lexicon. -Basic symbolic recognition exercises, syllables and words. - Grapheme naming exercises, visual lexical decision, word-drawing pairing.

		- Reading and writing exercises of graphemes, syllables, words and sentences. -Judgment exercises by mediated and forced choice. - Matching drawing exercises with the written word, lexical decision, recognition of the written word with phonetic analysis, grammatical and descriptive morphology. -Exercises to reinstate the reading system through the identification of letters, orthographic lexicon and grapheme-phoneme conversation mechanism. -Oral exercises for reading high and low frequency words and pseudo-words. -Reading comprehension exercises with the support of pictograms, sequences of actions and texts. -Exercises pointing out the spelling, written drawings denomination and copying of uppercase and lowercase letters. -Word dictation exercises, arbitrary spellings and pseudo-words. -Exercises on writing mechanics and encoding skills with word dictation. -Exercise of copying syllables, words, sentences and written text, reinstating the grammatical semantic aspect of spontaneous writing and writing of situations. Exercises on the narrative aspect of writing through the description of situations with visual support.

5. THE REASSESSMENT RESULTS AND THE THERAPEUTIC INTERVENTION PROCESS EVOLUTION

Reading Figure 1 details the performance comparison of the language evaluation pre-post test through the BETA battery, after the implementation of the intervention program based on the cognitive neuropsychological model. An advance in words' listening comprehension is determined by an increase in performance in phoneme discrimination (29/32), lexical decision (30/32), spoken word-picture pairing (28/30), and semantic association (28/30). However, lower performance in the tasks of object-action association (24/30), definition-word pairing (23/30), synonyms (22/30), and

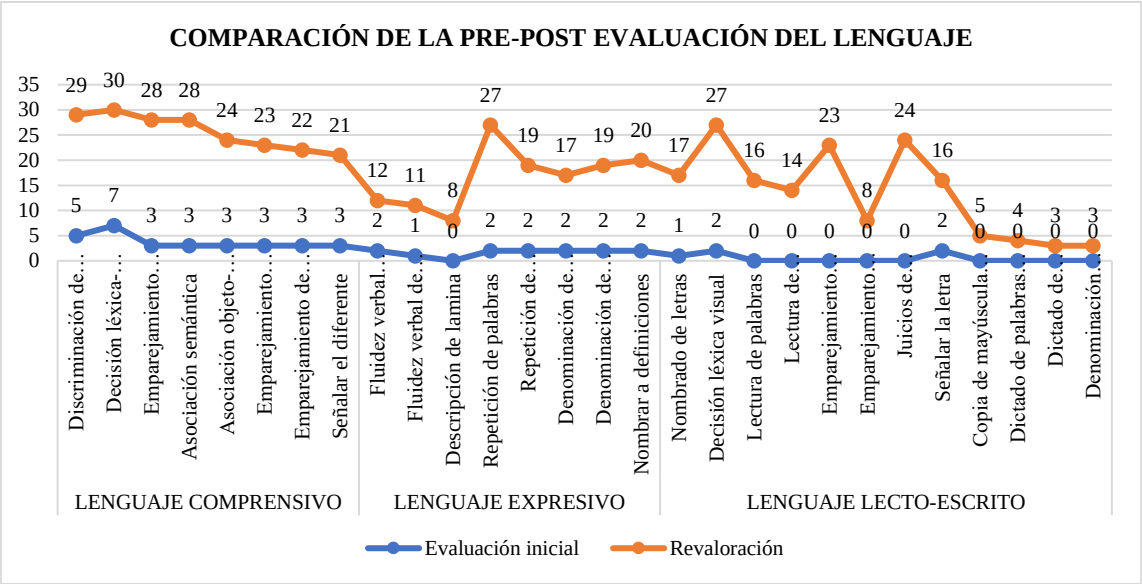
pointing different (21/30). Now, it is important to specify an improvement in the abilities of acoustic signal recognition for verbal information processing and the reduction of anomies linguistic errors, neologisms, and semantic and unrelated paraphasias. Also, to find and produce the word, structure simple and complex sentences morphologically, and organize oral discourse reducing errors of anomic and paragrammatic type.

In expressive language, development is denoted in semantic and phonological fluency tasks (12/15), naming people (11/ +5), sheet description (8/ +3), repetition of words (27/32) , pseudowords (19/32) and object naming (17/30), actions (19/30) and naming definitions (20/30). Therefore, an important change in the characteristics of the language at the phonetic, syllabic, word, sentence length, and oral discourse levels is inferred by the control of articulation and the specific decrease in phonetic and/or literal paraphasia errors. In addition, the compensation achieved in the naming objects skills and words semantic fields allows the reduction of anomies linguistic errors, semantic paraphasias, and neologisms, reaching an expressive language with more intelligible characteristics.

Regarding the reading-writing process, an advance is established in the components of naming letters (17/20), visual lexical decision (27/32), word reading (16/32) and pseudowords (14/30) pairing written word-drawing (23/30) and written sentence-drawing (8/30), grammaticality judgment (24/40), sign the letter (16/20), copy from uppercase to lowercase (5/8), dictation of words with arbitrary spelling (4/10), pseudowords (3//7), and written names of objects (3/10). Therefore, progress is denoted in the reading system reactivation, graphemes identification, orthographic lexicon, grapheme-phoneme conversion mechanism, and in the writing of regular and arbitrary words with a decrease in graphic and orthographic errors.

Given the significant evolution in the patient's linguistic behavior, it is suggested to continue with the speech therapy rehabilitation process to advance in a more functional communication that allows the inclusion in their family and social context through reinforcement activities consolidation, family accompaniment, and interdisciplinary therapeutic support.

Figure 2: Nombre de la figura? y hay que pasarla al inglés



6. DISCUSSION

The speech-language intervention was focused on the specific rehabilitation strategies application based on the cognitive neuropsychological approach with the language process favoring purpose through the activation of the praxic-orofacial components, articulatory production, thought-word representation, listening comprehension, and reading-writing with the orofacial-graphic motor apparatus exercise, articulatory and graphic motor plan, phonological, semantic, orthographic, syntactic lexical store, lexical and sub-lexical route based on the theoretical approach of Cuetos (1998) of the oral-written linguistic processing system modalities and the motor act programming based on the approaches of Patterson & Shewel (1987) and the models of specific cognitive functions reviewed by Benedet, 2002.

Thus, the general objective of cognitive neuropsychological intervention should be aimed at identifying the damaged mechanisms through an initial evaluation based on the characteristics according to the case under study and the recovery functions. (Fernández and López, 2005). Thus, rehabilitation program design focuses on three basic principles of a cognitive process model, a hypothesis about the brain damage nature, and how specific interventions can modify the functioning of impaired processes. In concrete practice, not only the typology of aphasia is sought, but also the directly injured mechanism for its restoration. In fact, the rehabilitation approach to the aphasic patient from this perspective must be done individually (Díez, 2014) in order to guarantee the possibility of improving the linguistic health of the aphasic person. (Caramazza and Hillis, 1990).

Hence, the role importance of the speech therapist in the linguistic rehabilitation of language disorders secondary to hemorrhagic stroke is justified, since the human communication professional has the anatomo-physiological knowledge of the nervous system and the clinical training for the evaluation actions development, and specific therapeutic strategies implementation for the

phonological-phonetic, grammatical, and semantic levels, in oral comprehension modalities, oral expression, reading, and writing. (Martinell, 2013). Likewise, it is necessary to keep in mind different factors that influence language fluency recovery, age, etiology, temporary installation factors, and time since the accident (Kertesz, 1988 as cited in Villodre & Morant, 2011). In the same sense, the duration and treatment intensity, family support, and the patient's attitude toward self-improvement provide valuable and decisive aspects for the effectiveness in the implementation of the treatment. (Cea, 2012, Villodre & Morant, 2011).

However, differences between the pre-post test measurements of the patient's language process were evidenced. Since important changes were obtained in phonetic characteristics, verbal fluency, information processing, organization, and oral and written structuring discourse with a decline in the oral linguistic errors of literal and semantic paraphasias, anomies, neologisms, para-grammatisms and of the reading-written language disorders associated with agraphia and alexia. After the intervention based on the linguistic system processing and the motor programming act through the orofacial-graphic motor apparatus activation, articulatory-writing pattern, word-thought representation, the phonological-semantic-syntactic-orthographic lexicon store, and the lexical-sublexical pathways that contributed significantly to intelligible speech and oral-written functional communication for its development in the family and social context. This is how it is established that individualized cognitive-based therapeutic intervention programs contribute to correcting difficulties at the phonemic construction level from the kinesthetic aspect and the reorganization of more complex thinking skills (Galindo et al., 2014), and the verbal fluency training that improves listening comprehension (Adelt, 2016 as cited in Luna et al., 2019). Besides, in reading-writing, when verbal language is re-established as an integral element of desires and needs ideational processes with the help of the necessary mechanisms' exercise for reading-writing, specifying which written word is the verbal language graphic translation that requires training of the audio-vocal circuits as essential components for writing together with the integrity of the inner language. (Rodriguez, 2015).

In fact, the case study findings should be disseminated to the scientific community. It trains speech therapy undergraduate programs faculties and professionals. It highlights the practical utility and benefits in the application of the intervention program based on the cognitive neuropsychological approach for the language disorders rehabilitation of central origin allowing care guides in adults to contribute and implement communicative health care routes.

7. CONCLUSIONS

The language rehabilitation based on the cognitive neuropsychological approach, from the initial evaluation process, allowed for the establishment of an intervention program. It was aimed to activate the damaged components' function. In addition, the reassessment determined the effectiveness of the implementation due to the significant changes in the oral production characteristics, listening comprehension, and organization of oral and written communicative discourse that allowed progress in communication skills in the family and social context of the patient.

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