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## Interventions in aphasia: an integrative review

### *Intervenções em afasia: uma revisão integrativa*

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#### ABSTRACT

This review aims to identify, evaluate and discuss articles of aphasia interventions and therapeutic advances, published in free access scientific journals in the last five years. An integrative review was performed on databases SciELO, LILACS, CAPES and PubMed, with the descriptors in English and Portuguese: aphasia, rehabilitation and treatment. Inclusion criteria were as follows: articles describing aphasia treatment or rehabilitation stories, published in English or Portuguese. It was found 96 studies that met the criteria that were read and analyzed according to an integrative review protocol, then categorized resulting in 26 articles included. It was observed a predominance of quantitative studies. Several studies that tested therapies showed positive results, confirming that aphasia is a condition that responds to a wide variety of treatments. Investigations focused on brain activation demonstrated significant correlations between patients' improvement and brain activation of language areas. It was found that aphasia treatments description did not indicate a superior therapeutic approach compared to another. Most studies did not present good degree of external general, indicating the need for controlled studies with more representative samples. The current literature should support the actions of the professionals, but these should be alert to the characteristics and limitations of the protocols tested.

**Keywords:** Aphasia; /therapy; Rehabilitation; Review

#### RESUMO

O objetivo desta revisão foi identificar, avaliar e discutir artigos sobre intervenções e avanços terapêuticos em afasia, publicados periódicos científicos nos últimos cinco anos, em plataformas de livre acesso aos profissionais. Foi realizada uma revisão integrativa nas bases de dados SciELO, LILACS, Periódicos Capes e PubMed, com os descritores em português e inglês: afasia, reabilitação e tratamento. Foram incluídos artigos que descrevessem tratamentos para afasia ou histórias de reabilitação, publicados em inglês ou português. Os estudos que atenderam aos critérios foram lidos e analisados segundo instrumento para revisão integrativa, e posteriormente categorizada. Dos 96 artigos levantados 26 foram incluídos na revisão. Houve predominância de estudos quantitativos. De modo geral, diversas pesquisas que testavam terapias mostraram resultados positivos, confirmando que a afasia é uma condição que responde a uma ampla variedade de tratamentos. Nos estudos cujo foco foi a ativação cerebral, foram encontradas correlações importantes entre a melhora dos pacientes e a ativação de áreas cerebrais relacionadas à linguagem. A partir dos resultados, verificou-se que os tratamentos para afasia descritos não indicam a superioridade de uma abordagem terapêutica sobre outra. A maioria dos estudos revisados não apresentava bom grau de generalidade externa, indicando a necessidade de estudos controlados com amostras mais representativas. A literatura atualizada deve fundamentar as ações dos profissionais, porém esses devem estar atentos às características e limitações dos protocolos testados.

**Descritores:** Afasia; Terapia; Reabilitação; Revisão

## INTRODUCTION

The aphasia is a condition resulting from an injury to the brain, usually in the left hemisphere, often caused by stroke. This etiology is more common in the elderly than in young people, and leaves as sequels circumscribed lesions and, often, permanent ones in the brain. Other diseases can also cause aphasia, such as tumors, traumas, degenerative or metabolic diseases<sup>1</sup>.

The brain injury present in aphasia can often lead to a disruption of language, which can affect the access to the vocabulary, syntactic organization, and encoding and decoding of messages<sup>2,3</sup>. Depending on the type of aphasia, the individual may present difficulties in fluency, comprehension, repetition, naming, reading, writing, paraphasias, agrammatisms or apraxias, and the aphasia can be classified into two categories, according to the manifestation of fluency: fluent and non-fluent<sup>4</sup>. As these injuries usually affect the left hemisphere, motor areas may be affected. Some of these areas are responsible for abilities of orofacial movements, resulting in non-fluent aphasia, which involve Global aphasia, Brocca and Transcortical Motor. These injuries may also affect associative and comprehension areas, causing fluent aphasia, which encompasses the aphasia of Wernicke, Conduction and Transcortical Sensory<sup>1,5,6</sup>.

For the treatment of aphasia it is necessary to consider factors such as type, location, etiology and extension of the lesion, as well as individual factors, such as age and hand dominance. The literature of the area has indicated that the most significant recovery happens in the first month after injury, then the next six months; after this time, the level of recovery may reduce, but the progresses is not limited<sup>7-9</sup>.

The treatment of aphasia is guided by therapeutic approaches that, in general, prioritize the stimulation, and is concerned with the functional activity of the communication, or still, prioritizes specific abilities that guide the identification of change and help in understanding the deficit, by proposing a specific treatment, at the level of these abilities. There are, also, social and psychosocial approaches, that can be used as a complement to the stimulation. There are, still, the multidimensional approaches, in which there is a commitment to the inclusion of the aphasic in social environment, without introducing, necessarily, a vision of healing. Regardless of the type of approach, the treatment for aphasia is generally long and must be diligent and the duration will depend on the initial prognosis<sup>10</sup>.

Over the past 15 years there has increased the number of treatments for this alteration. In addition to the approaches cited, new treatments are being developed, such as trans-cranial electric stimulation and the use of many other technologies adapted to certain demands, such as specific therapies for categorizations, naming of verbs, etc. However, there is no consensus on what is the best form of treatment, except for the notion that, whatever it may be it must be diligent. All approaches indicate successful cases and cases without improvement for the various types of intervention. This integrative review aims to identify, evaluate and discuss articles of aphasia interventions and therapeutic advances, published in scientific journals in the last five years in platforms of free access to the professionals directly interested in advances in this area. It is also necessary to discuss the characteristics of the samples studied, the proposed interventions, as well as their effectiveness and their possible biases.

## METHODS

The present study applies as a method the integrative review of the literature, which has as purpose to gather and summarize the scientific knowledge produced on a topic, in a given time period, allowing it to evaluate and synthesize the available evidence, thereby contributing to the development of knowledge on the issue<sup>11</sup>.

In order to guide the study and the discussion of the studies, the following guide question was formulated: What has been published in scientific journals in the last five years, with free access, on treatments for the rehabilitation of people with aphasia?

For the analyses of the researches, we consulted the databases from the Scientific Electronic Library Online (SciELO), Latin American and Caribbean Literature in Health Sciences (LILACS), Capes Periodicals and Public Medicine Library (PubMed), in September 16, 2014. These databases were chosen by understanding that they reach a larger share of professionals who have contact with the rehabilitation of the target population. The search was carried out in an orderly manner, in the sequence of bases pointed out above; in the first search it was selected publications that were indexed in more than one platform.

The following descriptors were crossed, in Portuguese and English: aphasia, rehabilitation and treatment and 96 articles of public access were found, published from September 2009 to September 2014. The criteria for inclusion of studies were: those that

addressed the theme of aphasia and its treatment or rehabilitation, with descriptions of the treatments or the history of rehabilitation, published in English and in Portuguese and in form of articles. Once these criteria were applied, we excluded those which did not submit content of free access, literature reviews and theoretical articles. From this first analysis, the reading of the titles of all articles was made checking 38 articles that met the research theme. Later, with the reading of abstracts and application of the criteria of inclusion, 33 articles were selected to integrate the phase of full reading. Of these, seven articles were excluded because they do not correspond to descriptions of treatments, some of which only mentioned a specific therapy without describing it, or addressing other areas of interest, such as adherence to treatment, without particular focus to the therapy. Therefore, this integrative review was made from a set of 26 articles.

The selected studies were analyzed and submitted to the criteria of the instrument for integrative review, validated by Ursi<sup>12</sup> (Figure 1), which includes the following items: identification of the original article, methodological features of the study, assessment of methodological rigor, the interventions measured and the results found. Then, the articles were ranked according to the type of evidence (meta-analysis, studies of experimental design, quasi-experimental design), qualitative studies, case reports and evidence of views of specialist<sup>13</sup>. The data were described using absolute (n) and relative (%) frequency.

The analysis continued with the categorization of studies, according to the topic of the search: general treatments, treatments with repetitive Transcranial Magnetic Stimulation and treatments with drugs (Table 1). For each category were checked the composition of the samples, the proposed interventions, effectiveness, considerations and biases. From this moment, the discussion by category was held, where each article was discussed in the light of the research designs used.

## LITERATURE REVIEW

We found ninety-six articles of which 26 were included in this review. Table 2 shows the number of publications found and selected in databases. Have researched articles with mash terms and have found only in three data bases, 79 of them on the platform PubMed, 15 in Scielo platform and two in Capes Periodicals. For the composition of the sample of this study, 25 publications were selected from PubMed and only one from Scielo (a case report).

In relation to the design of the studies, it has been identified that, of the 26 publications, 20 used quantitative approach (76.9 %) and of these 20, 75% of quasi-experimental studies (15), and 25% of experimental studies (5). The other studies (6) were case reports (23.1%). Therefore, there is the predominance of quantitative studies, with record of objective measures of improvement from the treatments tested.

The selected articles were published in 19 journals, with an emphasis on four magazines (*Brain and Language*, *Stroke*, *American Journal of Speech and Language Pathology* and *Journal Speech, Language, and Hearing Research*), responsible, together, for 42.3% of selected publications (11 articles of the 26 selected). The journal *Stroke* had the largest number of publications with experimental designs, with three publications.

The other journals (15 = 79% of the sample) had only one publication each selected to compose this study. Most of the publications are directed to the medical area.

It was observed that 11.5% of the articles were published in the year 2009 and 27% in the year 2013. In general, the studies were developed in the USA (16 = 61.5% of the total) however none of them presented experimental design. Other countries, such as Brazil, Germany and the United Kingdom, have published two studies each, and Germany and the United Kingdom have published only experimental researches. The other countries (Italy, Romania, Poland and South Korea) have published only one article each.

The articles were classified into three categories related to their theme: General treatments; Treatment with repetitive Transcranial Magnetic Stimulation and Treatments with drugs (Table 2).

## General Treatments

In this category are included 57.7% (n= 15) of publications whereas 15 of these publications (73.3%, n= 11) were conducted with quasi-experimental design (level of evidence B2 C), 13.3% (n= 2) with experimental design (evidence level 1A and A1B) and two (13.3 %) were case reports (level of evidence C4). This category include researches that used general treatments, with the objective of improving the language in patients with aphasia, using adapted treatments or protocols already consolidated, adapted to different situations.

There were found case reports of patients with Broca's Aphasia and Expressive Aphasia.

**A. Identification:**  
 Title of article \_\_\_\_\_  
 Title of the journal \_\_\_\_\_  
 Authors Name \_\_\_\_\_  
 Workplace \_\_\_\_\_  
 Graduation \_\_\_\_\_  
 Country \_\_\_\_\_  
 Languages \_\_\_\_\_  
 Year of publication \_\_\_\_\_

**B. Institution study**  
 Hospital \_\_\_\_\_  
 University \_\_\_\_\_  
 Research Center \_\_\_\_\_  
 Single Institution \_\_\_\_\_  
 Multicenter study \_\_\_\_\_  
 Other institutions \_\_\_\_\_  
 Does not identify the location \_\_\_\_\_

**C. Type of publication**  
 Publication of nursing \_\_\_\_\_  
 Medical Publication \_\_\_\_\_  
 Publication of another area of health. What? \_\_\_\_\_

**D. Methodological Characteristics of study**

1. Publication Type
  - 1.1 Search
    - Quantitative Approach
    - Experimental Design
    - Quasi-experimental Design
    - A Randomized non-experimental
    - Qualitative Approach
  - 1.2 Does Not search
    - Literature Review
    - Experience Reports
    - Other \_\_\_\_\_
2. Aim or research question \_\_\_\_\_
3. Sample
  - 3.1 Selection
    - Random
    - Convenience
    - Other \_\_\_\_\_
  - 3.2 Size (n) \_\_\_\_\_
    - Home \_\_\_\_\_
    - Final \_\_\_\_\_
  - 3.3 Characteristics
    - Age \_\_\_\_\_
    - Gender M ( ) F ( ) \_\_\_\_\_
    - Race \_\_\_\_\_
    - Diagnosis \_\_\_\_\_
    - Type of surgery \_\_\_\_\_
  - 3.4 Criteria for inclusion/exclusion of subject \_\_\_\_\_
4. Treatment of data \_\_\_\_\_
5. Interventions
  - 5.1 independent Variable \_\_\_\_\_
  - 5.2 Dependent Variable 13 \_\_\_\_\_
  - 5.3 Control Group: yes ( ) no ( ) \_\_\_\_\_
  - 5.4 Measuring Instrument: yes ( ) no ( ) \_\_\_\_\_
  - 5.5 Duration of study the \_\_\_\_\_
  - 5.6 Methods used for measurement of intervention \_\_\_\_\_
6. Results \_\_\_\_\_
7. Analysis
  - 7.1 statistical Treatment \_\_\_\_\_
  - 7.2 Significance Level 13 \_\_\_\_\_
8. Implications
  - 8.1 The conclusions are justified on the basis of \_\_\_\_\_
  - 8.2 What are the recommendations of the authors \_\_\_\_\_
9. Level of evidence \_\_\_\_\_

**E. Assessment of methodological rigor**  
 Clarity in the identification of methodological trajectory in the text (method employed, subject \_\_\_\_\_  
 Participants inclusion criteria/ex \_\_\_\_\_

Figure 1. data collection instrument (validated by Ursi, 2005)

**Table 1.** Journals Distributed in accordance with the themes

Theme	Design and Subcategories	Studies
General Treatments	RC	Beenson et al., 2013; Kunst et al., 2013.
	ED	Palmer et al., 2012; Bowen et al., 2012.
	Q-E D: Research p/ check the cerebral activation in distinct treatments	Breier et al., 2009; Sarasso et al., 2010; Fridriksson et al., 2012; Johnson et al., 2014.
	Q-E D: Research p/ check the recovery of a language skill specific	Parkinson et al., 2009; Kiran et al., 2011; Fridriksson et al., 2012b; Bonifazi, et al., 2013.
	Q-E D: Research p/ check the effectiveness of specific treatments	Nicholas et al., 2011; Kiran et al., 2013; Middleton e Schwartz, 2013.
Treatment with rTMS	Excitatory: Q-E D	Szaflarki et al., 2011; Allendorfer et al., 2012; Santos et al., 2013.
	Inhibitory: ED	Weiduschat et al, 2011; Waldowski et al., 2012; Thiel et al., 2013.
	Inhibitory: RC	Hamilton et al., 2010; Martin et al., 2009; Jung et al., 2010; Naeser et al., 2010.
Treatments drugs	ED	Jianu, et al., 2010

Note: Legend- case Report (RC); experimental design (ED); quasi-experimental design (Q-E D)

**Table 2.** Distribution of Selected Publications in the databases used

Databases	Aphasia, widescale. and Handled	Selected Publications	
		N	%
SciELO	15	01	4
LILACS	0	0	0
Period: Capes	02	0	0
PubMed	79	25	96
Total	96	26	100

Beenson, Higginson and Rising<sup>14</sup> verified the improvement of one specific language ability (communication by text) from two different treatments for a patient with Broca's aphasia. Kunst et al.<sup>5</sup> described the evolution of the general language of a patient with expressive aphasia. Although the results of both studies have been significant (with respect to the teaching of copy and writing recall in the study of Beenson et al.<sup>14</sup>, and in the communication for Kunst et al.<sup>15</sup>), to the first study, the conclusions were very generalized for a case study. Neither of the two studies brought up questions for possible future research, offering data restricted to specific questions.

The two studies with experimental design<sup>16,17</sup> aimed to investigate the effect of specific treatments (traditional therapy and self-managed treatment, respectively) in the rehabilitation of language in aphasics. Palmer et al.<sup>17</sup> tested a self-managed treatment in computer and its results were positive, showing that the experimental

group (34 individuals with non-fluent aphasia) have had the best performance in language when compared with the control group, nevertheless this difference was not maintained at the follow up. Analyzing the data, the authors suggested replication with greater control of the sample and the measurement of language with different instruments. The research of Bowen et al.<sup>16</sup> compared traditional treatment, focused in specifics difficulties, with the implementation of an intervention based on groups of daily and casual conversation, and their results indicated that there were no differences between the intervention and stimulation through conversations in the first four months after the stroke (389 individuals with severe aphasia and dysarthria). The results questioned the recommendations on what is believed to be the most productive for the stimulation, which would involve the first six months after lesion. However, the authors emphasize the importance of conducting other treatment types and comparing the

results with other populations, such as patients with chronic aphasia.

It was found a large number of studies in this category with quasi-experimental design ( $n = 11$ ). Of these studies, four had as aim to verify the cerebral activation in distinct treatments, four had as a goal to investigate the recovery of a specific ability of language, and three of them investigate the effectiveness of specific treatments in various language abilities.

Among the studies whose objective was to verify the cerebral activation in distinct treatments, three (IMITATE<sup>18</sup>; CILT<sup>19</sup>; CIAT-II<sup>20</sup>) may be characterized as intensive therapies, applied, in general, four to five times per week, with a duration of more than one hour per session. These studies used the same instrument to assess the performance in language Scale (WAB), which facilitated the comparison of their results. Sarasso et al.<sup>18</sup> promoted the teaching of phonoarticulatory movements by imitation and, besides the improvement of the four individuals with aphasia not fluent in WAB test, the authors also verified changes in ipsilateral hemisphere areas pre-motor and parietal regions, as well as in the frontal region of both cerebral hemispheres. Breier et al.<sup>19</sup> studied a protocol of language therapy induced by restriction and, in addition, found improvements in the scores of the 33 patients with severe aphasia on the test of language. They also found a correlation between the maintenance of this improvement and greater activation of the left hemisphere, as well as deterioration of this performance for the activation of the right hemisphere. The authors suggested the need for further studies with a larger sample and with a control group. Johnson et al.<sup>20</sup> tested the extension of the protocol by CILT for a specific aphasia (Broca), but without a control group and with only four subjects. The results showed improvement in the language for all participants, suggesting expansion of sample in subsequent studies, with greater experimental control of the protocol. The three studies have indicated that intensive therapy had significant effects on cerebral activation in patients with aphasia, producing improvements in scores on tests of language. Breier et al.<sup>19</sup> also suggested that the maintenance of the results were variable among patients, which may indicate need for greater investment in research on the correlation between the cerebral activation and the effectiveness of these treatments in the long term.

The study of Fridriksson et al.<sup>21</sup> examined changes in cerebral activation after training with different

speech feedbacks (auditory-visual; auditory only; and only spontaneous speech), in 13 patients with Broca's Aphasia. The authors found that the training with auditory visual feedback was the most effective which has generated a bilateral activation, with greater activation of language areas for the experimental group. The results of this research, despite the methodological differences, support results of Sarasso et al.<sup>18</sup>, which also showed a correlation between performance improvement in language and activation of brain areas related to language.

Among the studies whose objective was to investigate the recovery of a specific language ability, two examined the relationship between the improvement in the ability of naming, the cerebral activation<sup>22</sup> and the extension of the lesion<sup>23</sup>. Both studies involved 20 participants on average, with fluent and non-fluent aphasia, and used the techniques of semantic, phonological and gestures facilitators, which were compared among them. The results of both studies showed improvement in the ability trained, without significant difference between the techniques. The study also found correlations between the improvement of the patients and the activation of the frontal, parietal and temporal lobes (corroborating the findings of Sarasso et al.<sup>18</sup> and Fridriksson et al.<sup>21</sup>) and previous injuries. The two studies had no control group, which decreases the importance of these correlations, although such data are important and may indicate the need for further investigation.

The study of Bonifazi et al.<sup>24</sup> also presented as central interest the naming ability, more specifically the naming of verbs. For both, the authors tested different modes of observation of action, including the active observation (which requires an imitation response), in six patients with non-fluent aphasia. The results were promising for the naming of verbs, which increased by 100%, but the type of observation used was not a significant variable in the results that were found.

Therefore, the three studies that have had as interest the naming ability showed positive results, regardless of the treatment used, which suggests that this is an ability that responds very well to rehabilitation techniques.

A last quasi-experimental study<sup>25</sup> aimed to investigate the recovery of ability of categorization, after the application of a therapy for categorization of items with six patients with fluent, anomia and conduction aphasia. The authors compared two types of training for this ability, one with typical, and another with atypical items,

showing that the atypical items influenced positively the performance of the participants, when generalization was tested.

In the category of general treatments, three studies focused on testing the effectiveness of specific treatments in different language abilities<sup>26-28</sup>. All samples were formed by a similar number of participants (10 to 19), with diagnoses of bilingual, chronic and non-fluent aphasia. Only the study of Middleton and Schwartz<sup>27</sup> presented data from a control group. Kiran et al.<sup>26</sup> investigated the naming in bilingual aphasics, after a semantic treatment which consisted in choosing characteristics of specific elements. The treatment was divided into two groups, one of elements associated with a characteristic or questions on relevant items of stimuli and another group without these associations and questions. Improvement was verified in the naming and semantics for the most of the participants, and the bilingual training had better performances, without differences between treatments. However, the levels of fluency in the second language of the participants were not controlled. Nicholas et al.<sup>28</sup> investigated the effect of a computerized procedure (of alternative communication, which practiced the general language, communication on the telephone, writing and e-mail), on the expressive language of the patients. The results were significant for a few participants. Middleton and Schwartz<sup>27</sup> investigated the influence of occurrence (or not) of errors in three types of training: semantic, phonological and errorless. The semantic training was the one that had less influence of the occurrence of errors, that is, the experience with or without errors in this treatment did not influence the results demonstrated by the participants. This indicates that the experience with the error can influence the rehabilitation of aphasia, depending on the type of treatment. In this case, in phonological practice and errorless, the amount of errors influenced the participants' performance on the tasks proposed.

In general, the studies that have tested general treatments showed positive results, both for samples with diagnoses very well delimited, as for more specific abilities, confirming that the aphasia is a condition that responds very well to a wide variety of treatments. In studies whose focus was the cerebral activation, correlations were found between the patients' improvement and the activation of specific language-related brain areas. Thus, more studies are needed to replicate the most relevant data using larger samples, in order

to increase the generality of these results and better understand the correlations and benefits found.

### Treatments with repetitive Trans cranial Electric Stimulation (rTMS)

The researches on this topic represents 38.5% (n=10) of the total number of articles reviewed in this study. Three of these studies were conducted with excitatory rTMS and other seven with inhibitory rTMS.

The rTMS is a neurophysiologic technique that allows the induction of a magnetic field in the brain and is applied by placing a metal tool on specific areas of the skull for issue of magnetic pulses that act on the brain in a focused manner<sup>29</sup>. Depending on the frequency used, the stimuli may increase (excitatory) or decrease (inhibitory) the activity of the affected area of the brain. It is a technique that can be applied therapeutically, modulating (balancing) the neuronal functioning.

The three publications on the use of excitatory rTMS were performed with quasi-experimental design studies. Two of them<sup>30,31</sup> studied the same participants (n=8) with diagnosis of Broca's Aphasia (2011), and Broca's Aphasia or Anomic (2013). The same protocol was used in the two studies: three pulses of 50Hz repeated every 10 seconds, a total of 600 pulses. The study of 2011 stimulated Broca's area and the study of 2013 stimulated areas that responded maximally to language tests, identified by functional magnetic resonance (fMRI) study of 2011. Both studies showed changes in cerebral activation, especially in areas of decisions in semantic study of 2011. In addition, participants in the two studies showed improvement in language tests, especially in the fluency in study of 2013. The number of subjects in the sample was limited, which restricts the generality of external results, besides not presenting a control group to ensure the effects of the treatment.

Santos et al.<sup>32</sup> also worked with excitatory rTMS, and used a protocol with stimulation of 2mA, for 20 minutes, for 10 consecutive days, in 19 patients (eight with Broca's Aphasia, seven with Anomic aphasia and four with Mixed aphasia). Improvements in all patients were recorded on tests of language and abilities such as the understanding of sentences, naming and fluency. The limitations of this study, however, are the same as the two studies previously described: need for replication with greater experimental control (stimulation of other brain areas and inclusion of a control group). In general, the three studies in the area of excitatory rTMS

demonstrated the efficiency of the treatment, especially in people with non-fluent aphasia.

The researches with inhibitory rTMS were conducted with experimental design (three studies) or they were case reports (four studies). In general, they had greater experimental control. The inhibition in the brain is almost always in the areas of the right hemisphere counter-parts to the areas of language of the left hemisphere, as determined from previous research by fMRI the best activated area during activities of language.

The three experimental studies<sup>33-35</sup> have used similar protocols: stimulation of 1Hz, with five to 10 consecutive stimulations at 20 minutes, eight to 10 sessions, totaling two weeks of stimulation. All studies included control groups and multiple diagnoses of aphasia (non-fluent and fluent aphasia). The aim of these investigations was also the general abilities in language and, more specifically, naming in the study of Waldowski et al.<sup>34</sup>. It should be noted that the studies were carried out with small number of participants (10, 26 and 24, respectively), and the replication on larger samples would be important to confirm the findings. Thiel et al.<sup>35</sup> and Weiduschat, et al.<sup>33</sup> applied, in addition to the rTMS, speech therapy to both groups, thus ensuring an environment that is more close to the real, since therapy speech is the preferential treatment for cases of aphasia<sup>36</sup>.

The results of the three studies were promising. Improvements were recorded in the language, measured by means of specific tests, and also changes in cerebral activation for the study of Thiel et al.<sup>35</sup>. This study also aimed to test the protocol of rTMS to start immediately after the stroke and obtained as a result satisfactory performance, that corroborate data in the literature indicating that the immediate start of rehabilitation can promote the rapid improvement of patients<sup>7</sup>. The conclusion of Thiel et al.<sup>35</sup>, however, should be considered in the light of the data in the study of Bowen et al.<sup>16</sup>, who demonstrated that the daily stimulation is capable of producing the same effect in rehabilitating aphasics, during the first four months after the aphasia. Therefore, to determine the impact of a treatment for aphasia soon after the stroke in comparison with effects of spontaneous recovery and with stimulation effects in the natural environment seems to be a major challenge for research in the area.

All four case reports on the use of rTMS followed the same protocols, applied in specific brain regions, as determined by examination of previous image. All of them were applied to specific cases of non-fluent

aphasia. In studies of Hamilton et al.<sup>37</sup> and Martin et al.<sup>38</sup>, the stimulation protocols were applied in three subjects (one and two, respectively) with chronic aphasia (more than a year). The results were significant for the improvement of the language in the case of the study in 2010 and for one of the participants of the study in 2009, indicating that the same protocol may not produce the improvement of language for all patients, depending mainly of injured areas, issue discussed by Martin, et al.<sup>38</sup>, and indicated in the Sarasso et al.<sup>18</sup>, Fridriksson et al.<sup>21</sup> and Fridriksson et al.<sup>22</sup> studies.

Jung et al.<sup>29</sup> and Naeser et al.<sup>39</sup> aimed to study the rehabilitation of speech in a case of Global Aphasia with the right dominant hemisphere, and non-fluent Aphasia associated with sleep apnea. Both studies showed improvements in language in tests, but the studies raise discussions such as, for example, the use of fMRI, that may not ensure what the patient is executing at the time of the exam, not providing an accurate description of the effects of treatment in the case of the patient performing other tasks than those requested by the examiner. This also applies to the research of Naeser et al.<sup>39</sup> in that the sequence of treatments (treatment for apnea and TMS) does not guarantee the separation of the effects of each therapy alone, limiting the discussion on the benefits of the same when applied individually.

In summary, the protocol for application of excitatory rTMS seems to be well established, so that the experimental work, with greater methodological rigor and experimental control, replicates results obtained from case studies. It is possible to observe, also, that the overall results have beneficial and that this type of stimulation is being used more than the inhibitory rTMS.

## Treatments with drugs

It was found only one publication that reports treatment of aphasia with drugs, and it will be discussed separately because this type of research presents a very different treatment. The research of Jianu et al.<sup>40</sup> aimed to verify the effectiveness of the drug Cerebrolysin for the treatment of Broca's Aphasia (2212 patients). The Cerebrolysin is a drug that produces enzymes with the ability to break and purify proteins of the brain, in addition to activating peptide molecules and free amino acids. The drug administration was conducted during a window of 72 hours, in addition to administration of placebo to the control group. The measures abilities in language tests have improved with time in both groups, with significant increase in the experimental group, and this effect maintained at *follow up*. Although the

study has demonstrated good therapeutic results, the authors suggested the increase of the sample (the final sample consisted of 425 individuals), data collection of a baseline for the ability of understanding, use of fMRI and different intervals of administrations.

## CONCLUSION

From the results discussed here, it is noted that the treatments for aphasia described in recent literature does not indicate the superiority of a therapeutic approach over another, nor identify patient conditions that justify the use of one or another treatment of specific rehabilitation. In addition, the positive results found with rTMS are still preliminary and have obvious limitations, such as the extension of its use as therapeutic procedure standard and access to the population of interest. The majority of the studies reviewed here do not have good degree of external generality, which induces the concern that, when selecting a treatment, the professional must be aware of the peculiar characteristics of each case, periodically reevaluating the approaches and treatments applied. In addition, the data described here strongly indicate the need to conduct a systematic replication of most relevant studies, with larger samples, thus, improving the understanding of the correlations and benefits that these treatments have suggested. This way, the professional will be more able to make decisions on changes to the approach chosen on the basis of the development of the framework and empirical evidence, always taking into consideration the limitations of each study and the indications set out in the protocols tested.

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