Broca’s Aphasia and Wernicke’s Aphasia

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Broca’s and Wernicke’s Aphasia

Aphasias are disorders that affect the language areas of the brain. They are most commonly seen on the left side of the brain in the temporal lobe or frontal lobe. Aphasias can be caused by certain damages to the brain like a stroke, head injury, tumor, or neurological disease (What Is Aphasia? — Types, Causes and Treatment, 2020). The two most common types of aphasias are Wernicke’s aphasia and Broca’s aphasia. Wernicke’s aphasia occurs when there is damage to the temporal lobe and causes patients to speak in complete, nonmeaningful sentences with no direction and often times includes made-up and unnecessary words. Patients are usually unaware of their mistakes, but others cannot make sense of their sentences or understand their speech. Broca’s aphasia occurs when there is damage to the frontal lobe and causes patients to lack motor skills on the right side of their body and these patients typically understand speech, but have trouble producing it. They may speak in small phrases or only one word, but it takes a lot of work and effort to produce even those. These patients tend to be aware of their difficulties taking a large toll on their mental health and productivity due to frustration. Brain injuries that turn into these aphasias take a lot of work to treat. This paper looks into current and future treatments for Broca’s and Wernicke’s aphasias and their potential outcomes in improving the patient’s lives.

Broca’s and Wernicke’s aphasia have different types of treatment. One common and well-researched treatment of Broca’s aphasia is melodic intonation therapy (MIT). This is a standard therapy used for Broca’s aphasia in that it teaches the patients intoned speech and with practice, helps develop this into their natural way of speaking with connected words into sentences (Zumbansen et al, 2014). Intoned speech is a process in which the patient learns to speak in a music-like way using short sentences with simple pitch and rhythm patterns. They
take this process and normalize it into their normal speech patterns to have the ability to form sentences and communicate better with others. Another behavioral treatment used in Broca’s aphasia is conversational therapy treatment. This focuses on spontaneous conversation, so the patient has to control their impulses and eventually train them to elicit natural conversation.

Constrained and unconstrained intensive treatments are therapies used in Broca’s aphasia. Constrained intensive treatment is avoiding the use of compensatory movements such as writing, pointing, or gesturing in order to force communication to be talking only (Carragher et al, 2015). Unconstrained is being able to use all forms of compensatory movements along with talking to convey speech. One example of this type of treatment is constraint-induced aphasia treatment. This is when the patient is flooded with information by high-intensity repetitive tasks while constraining compensatory movements and only allowing the mouth to be moved to convey speech.

A main focus of Broca’s aphasia is helping the patient to create the vocabulary in their mind and be able to verbalize each noun and verb to create sentences. One type of treatment that helps with this development is script training. This is when the speech language pathologists and the patient create scripts together that are a combination of sentences that are similar to a monologue. These are rehearsed and trained in order to help with natural speech later on. Verb network strengthening treatment (VNeST) is another form of therapy that focuses on verbs in order to connect them with nouns they already know and are learning. They use flash cards to learn “who” and how they perform the “what” and connecting those with a verb. Speech entrainment is another therapy that uses rehearsal to develop into natural language. This is when a patient learns to mimic audio-visual speech stimuli in order to produce the same speech given.
Mapping therapy and ORLA methods are also used in Broca’s aphasia to work on implicit and explicit learning. Mapping therapy works on the connections between meaning and syntax to combine them into forming sentences by making the patient identify verbs, nouns, and themes of sentences in a combination of a written and spoken format and then work on creating sentences themselves (Schwartz et al., 1994). ORLA stands for oral reading for language in aphasia and this technique makes the patient systematically repeat sentences aloud in unison with the speech pathologist, and over time, independently.

One laboratory treatment used in Broca’s aphasia is electromagnetic articulography treatment. This treatment uses a helmet to emit low magnetic fields in order to track articulation movements of the mouth, tongue, and jaw (Joglar, 2009). Another laboratory treatment often paired with behavioral treatments is transcranial direct current stimulation (tDCS). tDCS is a low stimulation current applied directly to the scalp to enhance cognitive functions (Westwood, 2017). Both of these treatments can be used by themselves but also with the other therapies mentioned.

Wernicke’s aphasia does have some common treatments as Broca’s aphasia such as tDCS and constrained intensive treatment. Situational therapy is one that is solely used in Wernicke’s aphasia. This is a therapy that involves placing patients in simulated or real-life scenarios that imitate functional situations to train them into using their non-language communication skills and compensatory behaviors to improve practical functioning (Altschuler et al., 2006). Semantic therapy is another treatment that involves training the patient to attach meaning to words so their gibberish that comes with the aphasia can start to have meaning in their heads and lessen over time.
Something that contrasts from Broca’s aphasia treatments is that computerized therapy materials are often used with Wernicke’s aphasia treatments. These types of therapies can be used because these patients are good at adhering to the modeled behaviors presented and they have the language already there, it is simply restraining what is meant to be said and what is jargon. Also, pharmacological treatments are often used with Wernicke’s aphasia to help with the cause because it is often due to a stroke. The complications that come along with Wernicke’s aphasia can be treated with drugs, and they also help with the language inhibitions these patients lack. With all of these treatments, Broca’s aphasia and Wernicke’s aphasia have no official cure or preventative measure, but with these therapies, the symptoms can be minimized, and normal functioning can be learned over time.

**Broca’s Aphasia**

Broca’s aphasia can be caused by a stroke to Broca’s area, a traumatic brain injury, a tumor, or a brain infection (Acharya & Wroten, 2020a). Broca’s area is responsible for speech production, grammatical structure, and other language functions. This type of aphasia impairs those functions and causes much frustration among patients because they know what they are trying to say and have it in their mind but cannot convey it with speech. The therapies mentioned help with improving normal language function and producing long-lasting results that allow them to speak functionally again.

Melodic intonation therapy is one of the most common treatments in Broca’s aphasia. With melodic intonation therapy, the question of reliability stands in the way when it comes to language. An interesting point is if it works with just English or if it can be seen as reliable across languages. Al-Shdifat et al (2018) looked into language’s reliability in Arabic-speaking persons with aphasia using an 8-week process measuring accuracy of production of trained and
untrained phrases during the process, immediately after, two weeks and four weeks after training. They concluded that MIT was a reliable treatment option for Arabic-speaking patients with concessions of needing a larger group of people for future studies from a more wide-ranging variation of countries with Arabic-speaking people.

One big question with melodic intonation therapy is if solely singing is the main part of treatment or if it has to do with the components of rhythm and pitch. Stahl et al (2013) looked at this difference to see if there was any real difference and the implications of simply using singing or if it was better to use melodic intonation therapy and found similar effects for both in the treatment outcomes. This study saw that with common phrases, both singing and rhythmic therapies show similar results of good progress in production with long-lasting results. Overall, the combination of singing and details that go into rhythmic therapies like melodic intonation therapy show the best results in production of speech.

Melodic intonation therapy seems to be a very effective treatment for Broca’s aphasia patients that have damage to their Broca’s area, but other areas in the brain can cause these aphasias as well. Damage or lesions to the basal ganglia can lead to Broca’s aphasia because of its functions in language. The basal ganglia is typically involved in reading tasks, along with semantic processing and language processing (Booth, 2007). Shi & Zhang (2020) looked at how with melodic intonation therapy, it uses mechanisms that target basal ganglia functions like rhythm processing, function of temporal prediction, and motor programming and execution. Their results showed that rhythm processing used in melodic intonation therapy had the main effect on rehabilitation for Broca’s aphasia and that the basal ganglia may have a strong tie to this aphasia along with Broca’s area.
One of the key hopes of melodic intonation therapy is to create new pathways in the brain and form new connections in the non-damaged areas. Seeing as Broca’s aphasia comes from damage in the left hemisphere, the connections need to be made in the right hemisphere. For speech, the right hemisphere is useful with features such as the superior temporal lobe for auditory feedback control, premotor regions for planning auditory-motor mapping and actions, and the primary motor cortex for execution of vocal motor actions. All of these regions are connected by the arcuate fasciculus which is a major white matter tract that is usually not as strong in the right hemisphere than in the left. Schlaug et al (2009) looked to see if there would be an increase in the volume and amount of arcuate fasciculus fibers in the right hemisphere after MIT. They administered the therapy as it is routinely done in the therapy setting and using diffusion tensor imaging, found a significant increase in the volume and amount of arcuate fasciculus fibers in the right hemisphere, suggesting that new pathways are being formed and allowed for sustained positive effects from MIT to occur in patients. Being as the researchers were only looking for changes in the arcuate fasciculus, that is the only changes they saw. Future studies could look into changes in other areas surrounding the Broca’s area to see any other neurological changes.

Melodic intonation therapy has been suggested to have great effects and create new networks in the right hemisphere as we have seen now, but another potential therapy could help speed up the process and enhance its positive effects. Transcranial direct current stimulation (tDCS) is a noninvasive way to modulate neural activity in the brain (Norton & Schlaug, 2011). Current research is testing how tDCS can be used while performing MIT in patients with Broca’s aphasia. The tDCS was applied to the posterior inferior gyrus of the right hemisphere because of its effects on articulatory actions through singing and significant results were shown in that there
was an increase of positive effects from MIT with tDCS. This further helps with the suggestion that new pathways are created in the right hemisphere after damage to the left hemisphere, and tDCS could be used to enhance and increase these connections.

While the last study used tDCS on the posterior inferior gyrus in the right hemisphere, Marangolo et al (2013) wanted to look at the effect of tDCS on the left inferior frontal cortex, specifically in Broca’s and Wernicke’s areas. This study didn’t use MIT and instead used conversational therapy treatment, which uses another person to elicit spontaneous conversation, so the patient has to act quick and impulsively to train their natural reactions. These subjects were shown videos in which conversation was elicited randomly during these videos and the tDCS was activated when they had to talk about the contents of the video. With Broca’s area, improvements were shown in categories such as content units, verbs, and sentences directly after treatment, and one month after, showing long-lasting effects. These improvements were significantly higher in Broca’s area rather than Wernicke’s area, so combined tDCS and conversational therapy could be a potential influential treatment with Broca’s aphasia. These results also suggest stimulating Broca’s area brings back the function that was lost with Broca’s aphasia. Seeing the lasting effects, a treatment plan could be created that includes doing the tDCS plus conversational therapy once every two or three months to sustain the positive effects, and eventually lead to normal functioning.

While damage to Broca’s area in the left hemisphere is apparent in Broca’s aphasia, Marangolo et al (2013) showed that stimulating the damaged Broca’s area with tDCS has shown positive effects on verb and sentence formation. Cattaneo et al (2011) looked at the improvement of phonemic and semantic fluency tasks for Broca’s aphasia patients to assess language advances with tDCS over the Broca’s area. This study found that there was a significant increase in
production of words for both the phonemic and semantic fluency tasks and an overall improvement of language functions in Broca’s aphasia patients compared to healthy controls. tDCS therapy has positive effects for Broca’s aphasia symptoms whether it be stimulating right on Broca’s area or other language areas of the brain that have formed new pathways and networks in order for these patients to function.

Looking for new pathways in the brain is key for improvement of treatment for Broca’s aphasia. Other language areas and places in the brain that can be utilized for language functions would need to be used in order to increase speech production and articulation. Galletta et al (2015) looked at using tDCS in stimulating not only Broca’s area, but Wernicke’s area as well. They used five different electrode montages with one over the left Wernicke’s area, left Broca’s area, right Wernicke’s area, left Broca’s area, and one that was a bilateral stimulation over the left Broca’s and right Broca’s area simultaneously. They wanted to measure which of these would produce the most effective language improvements. The results showed that when doing the last montage, over the left and right Broca’s area, showed the highest improvement of function. These results suggest that maybe the brain can find new pathways, but if the area of damage is stimulated, the effects could be just as good and could provide a better treatment course. Also, with the obvious improvements in language function from stimulating just parts of Broca’s area, this study shows that stimulating both the left and right parts of it, have the best results and should be applicable to other studies using similar methods.

tDCS helps with certain symptoms of Broca’s aphasia, but other therapies alone, or added with tDCS can help more specific problems. One major language function that Broca’s aphasia hinders is articulation issues in the production of language. A potential treatment to help alleviate this is electromagnetic articulography treatment. This uses low strength electromagnetic fields to
measure things like the jaw, tongue, or lips. Katz et al (1999) performed two tasks, one visually
guided biofeedback looking at tongue-lip position, and one foil treatment in which a computer
program gave voicing-contrast stimuli for simple repetition, to contrast which task would be
better at treating Broca’s aphasia and show the best results in articulation. They found that visual
biofeedback concerning tongue-lip position shows the best results with Broca’s aphasia patient,
especially patients who are completely mute and have trouble with speech motor behaviors.

With all of these treatments, the main goal is to have long-lasting effects so that the
patient can function in everyday society and speak in normal conversations. Carragher et al
(2015) wanted to track outcomes of patients who had been through language production
therapies and assess their everyday conversation skills. They used a form of treatment called
constrained intensive language treatment and compared it to unconstrained intensive language
treatment. They found that using constrained assessment tasks didn’t apply to everyday
conversations as much as unconstrained. Constrained tasks are when patients are taught to
produce language without compensatory communication like gesturing, pointing, or writing.
This study showed that long-term effects are shown more when the treatment most reflects real-
life conversations using hand and face motions.

A specific type of constrained intensive language treatment is constraint-induced aphasia
treatment. This treatment has been shown to have some long-lasting effects because constrained
treatments can be effective in building vocabulary and the start of forming sentences in working
its way to using it in everyday life. Johnson et al (2014) used constraint-induced aphasia
treatment in Broca’s aphasia patients in order to see its effects on everyday speech and language
and making it come more naturally. They used this type of therapy because it involves high-
intensity repetitive tasks that occur in a short timespan to somewhat flood the patient with
information in order to make it natural and part of their daily language. Their results suggested participating in this type of therapy may improve everyday speech significantly, but it is only preliminary and should be tied with another type of treatment to make it more useful long-term. Past studies showed that constrained intensive language treatments aren’t long lasting by themselves, but future studies could tie these methods with other therapies such as tDCS or another behavioral therapy to see longer lasting effects.

A new treatment that involves improving natural language functions and has longer-lasting effects is script training. The key to the scripts is that the words are easy to predict in that they go together like a story. This technique is working to restore and improve natural speech production for context-specific stimuli (Ali et al, 2018). This study used a Broca’s aphasia patient and tested script training as a therapy to see the resulting effects. They found robust positive effects with each trial in that the patient retained each of the scripts and maintained them after the completion of the study. By practicing and learning these scripts, functions like word retrieval and production of sentences were increased dramatically. This sustained effect suggests that the content of the scripts must be effective enough to be learned and turned automatic. The more positive effects seen from script training, the more automatic they become, and the longer lasting they remain.

Another treatment that focuses on the same topic of improving speech production is verb network strengthening treatment (VNeST). This therapeutic option focuses on verbs and word finding to produce complete sentences. Costello-Yacono & Balasubramanian (2018) did a study comparing script training and verb network strengthening treatment to measure rate of speech, sentence production, and error rates. They had one participant use script training and the other use VNeST with the same diagnosis and same symptoms of the Broca’s aphasia. They found that
both treatments were equally as helpful, and a potential multi-treatment model could have significant positive effects for future studies. These studies combined could show an even great benefit in improving sentence production of Broca’s aphasia patients.

When improving speech production, sentence production is the hardest goal to attain for Broca’s aphasia patients. These patients may sometimes blurt out words if they can, but mostly have trouble producing words and sentences. One helpful treatment for learning to create fluency with their words and sentences is speech entrainment. Fridriksson et al (2012) looked into the neural mechanisms in Broca’s aphasia patients behind this training and tested to see if audio-visual feedback was the most effective rather than simply audio-only or spontaneous speech. This was tested against normal, healthy individuals to see what brain mechanisms were at play. They found that patients produced a greater variety of words with audio-visual feedback than spontaneous speech or audio-only. Also, fMRI studies were used to look into the neural mechanisms behind this type of training and found greater bilateral activation for the audio-visual task in the anterior insula and Brodmann’s area and in the left middle temporal gyrus and dorsal region of Broca’s area. Speech entrainment overall helped with speech production and supplying a greater number of words that patients may use in sentences as they learn to form them aloud. Knowing the brain areas at play, more treatment could be looked into that affect these areas and possible tDCS could be used in these areas as well to see language improvement.

Since there is virtually no sentence or speech production with Broca’s aphasia, these patients are often diagnosed with agrammatism. This is when their vocabulary mainly consists of nouns and content words with simplified syntax, short phrases, and no verbs. Silagi et all (2020) looked into whether implicit or explicit learning was better for treatment of those with agrammatism using mapping therapy and ORLA methods with oral and written production in
spontaneous speech. They found that the mapping therapy helped significantly with written production and ORLA helped significantly with oral production, suggesting that both implicit and explicit learning are effective treatments with Broca’s aphasia. The mapping therapy helped connect words into sentences so they could be written out and understood by the Broca’s aphasia patients. ORLA is an oral production technique that works with also connecting words into sentences, therefore both of these techniques together produce great results for Broca’s aphasia patients.

**Wernicke’s (Fluent) Aphasia**

Wernicke’s aphasia is caused by an ischemic stroke, brain trauma, a tumor, central nervous system infections, or a degenerative brain disease (Acharya & Wroten, 2020b). Wernicke’s aphasia comes from damage to Wernicke’s area in the brain. The speech output of a Wernicke’s aphasia patient is fluent, but usually difficult to understand because of the repeated jargon and gibberish-sounding words. These patients usually have a lack of comprehension of language, deficits with repetition and naming items, and abnormal word choice and spelling. These patients are less aware of their deficits as opposed to Broca’s aphasia patients who are more aware. Therapies for Wernicke’s aphasia are far fewer than the therapies for Broca’s aphasia because of the lack of language comprehension and awareness of errors.

As mentioned before, one main difficulty in Wernicke’s aphasia is deficiencies in language comprehension. Recovery and treatment for this can be very difficult because the factors undermining it are unclear. Robson et al (2019) looked into whether auditory, phonological, semantic, or executive factors are the main target in recovering language comprehension for Wernicke’s aphasia in post-stroke patients. Each of these factors has their own effect on language comprehension in the normal brain, so seeing which can be used in
therapies most and have the best results is helpful in creating future treatments. Their results suggested that the best results happened with auditory and phonological processing factors. These predicted the fastest comprehension recovery outcomes compared to semantic, or executive functions. This meaning in order for comprehension to recover, treatments need to include factors that tend to auditory and phonological processing. This is helpful in looking at treatments already created to see if they focus on these factors, and in the creation of new treatments to focus more on the auditory and phonological processing in the brain.

As with Broca’s aphasia, transcranial direct current stimulation (tDCS) is being used as a treatment in Wernicke’s aphasia as well. You et al (2011) looked at comprehension improvement by using tDCS on two groups with each getting have it on either the left superior temporal gyrus (left Wernicke’s area) or the right superior temporal gyrus (right Wernicke’s area). Both groups showed improvement with spontaneous speech and auditory verbal comprehension, however there was significantly more improvement with auditory verbal comprehension for the tDCS on the right superior temporal gyrus. This suggests that tDCS would be a good treatment when placed on Wernicke’s area, the right side specifically, but could lead to future studies of doing both sides at once to see an even greater improvement.

tDCS is a powerful treatment but combined with other therapies could show greater improvements that are more long-lasting. Jung et al (2011) looked at tDCS combined with speech therapy across different aphasias stimulating Brodmann area 45 to look for language improvements and less deficiencies with their certain aphasias. Their results suggested that the most improvement was seen in less severe fluent aphasias which includes Wernicke’s aphasia. These findings give good background to the idea that tDCS is a strong treatment but combined with another type of therapy could show even better results for Wernicke’s aphasia.
A therapy that could potentially be paired with tDCS is situational therapy. This treatment places patients in a real or simulated situation and allows them to learn how to use non-language skills for functioning that they already possess (Altschuler et al, 2006). Wernicke’s aphasia patients can communicate in other ways besides speaking such as movements, gestures, expressions, or actions. This type of therapy allows them to use those in real-life situations such as using a taxi or going to the grocery store in order to allow them practical life functioning. These types of real-life examples allow the patient to use their nonverbal communication skills to function in normal life. Paired with tDCS and a communicative therapy, this could allow a patient to learn how to live their everyday life in a somewhat normal way with long-lasting effects.

Two other types of therapies often used with Wernicke’s aphasia are constraint-induced aphasia therapy, which is also sometimes used in Broca’s aphasia, and semantic therapy. Constraint-induced aphasia therapy involves high-intensity repetitive tasks that occur in a short time span. Semantic therapy is used to improve naming abilities by creating semantic mapping with verbal and visual cues of features of a specific word that eventually leads to self-cues in order to function in everyday life. Wilssens et al (2015) compared these two treatments in Wernicke’s aphasia to see their effectiveness in behavioral treatment outcomes. Their results indicated that both therapies improved verbal communication, but semantic therapy showed a more significant improvement because it focuses more on the meaning of words. This being, the patient could connect the meaning of the word to how it should be used and could better communicate the accurate words to their thoughts. Semantic therapy also showed improvement in language comprehension and semantics, while constraint-induced aphasia therapy showed
improved in language production and phonology. Both of these treatments are very intense, but effective in Wernicke’s aphasia patients and could possibly show even better results combined.

While constraint-induced aphasia therapy can be used for both Wernicke’s and Broca’s aphasia, semantic therapy seems to be more predominant with treatment of Wernicke’s aphasia. Kiran & Thompson (2003) used semantic therapy to look at improvements of naming within semantic categories and generalization. The patients were trained to learn semantic features of typical and atypical items and tested generalization with untrained items. When looking at typical and atypical items, they were using categorization techniques. For example, if the category was bird, a typical item would be a robin or cardinal and an atypical item would be an ostrich. They found that training atypical items and their semantic features resulted in generalization to naming typical items used in training. This was not the same case when training typical items, those did not lead to generalization of any kind. These results suggest that learning atypical items is effective in facilitating generalization to untrained items, therefore semantic therapy would be very beneficial if it is focused on featural detail of categorized items for improving naming.

Generalization is a key factor in the treatment of Wernicke’s aphasia patients. Naming therapies have shown positive results in most studies with the monolingual population, but the question arises of if these therapies can be generalized to the bilingual population as well. Croft et al (2011) looked into this question along with asking if different languages respond differently to therapy and if the dominant language will be the main one to improve. They tested subjects who were bilingual in English and Bengali in which they did therapy in two phases, one in English and one in Bengali. Each phase had semantic and phonological tasks in which they measured typical and atypical items they could name. The results showed some cross-linguistic
generalization when the treatment occurred in their dominant language using semantic tasks. Also, that typical items used in treatment can be effective for bilingual speakers. These results suggest that naming therapy techniques can produce cross-linguistic generalization, it just has to be done correctly, in both languages, with a lot of work put into the process in order to produce long-term results. These results also bring in the topic of typical and atypical items with contrasting results to the previous study. To promote learning or typical and atypical items in hopes that the knowledge of both is beneficial, future studies could look into the combination of naming therapy and semantic therapy.

A common symptom of Wernicke’s aphasia is neologistic jargon. This is the when the patient comes up with non-existent words and uses other words rather than the words they are trying to say aloud. What they are saying and what they are trying to convey are not alike at all. This is a hard symptom to treat and lots of therapeutic interventions don’t help with this certain symptom. Hough (1993) looked into a treatment that involved visual and written information and a hierarchy of visual word and sentence comprehension tasks. The results indicated improvement over a two-month period after eight months of no improvement with other therapeutic interventions. The notable effects were in naming abilities and general ability to communicate in conversation with reductions in neologistic jargon and increases in semantic jargon, which are words that make more sense to what the patient is trying to convey, but still mixed up sometimes. Overall, this type of treatment shows promising results for neologistic jargon symptoms, but over time made need revision and other therapies added onto it in order to decrease jargon in general.

One interesting new treatment is the use of computerized therapy materials so that a patient may not have to go to therapy in person. Ball et al (2018) wanted to look into if this
treatment option was effective and would actually be used. They looked at adherence to procedures and accuracy while practicing word production using interactive, multimodal, user-controlled, and word-level programs using the computer. They found that the patients sometimes adhered to the modeled behaviors while some created novel behaviors. Overall, they tended to not comply with instructions, but this didn’t reflect their successes. Improvement in word production was varied throughout the patients showing this kind of therapy may work for some, but this study helped to show some unanticipated dimensions for this type of treatment. Applying this to real life, older adults who may have trouble leaving their homes or children who have working parents who can’t go the therapy during normal working hours could potentially use this treatment, but with varying results may be more testing to be recommended to this group of individuals.

Most of these treatments are clinician-based, but medication is also involved in these aphasias. These pharmacological treatments are used for side effects from the stroke, if that was the cause, to improve blood flow to the brain, or replace depleted neurotransmitters. Woodhead et al (2017) used a pharmacological intervention using donepezil, a cholinesterase inhibitor that is used as a cognition-enhancing medication, to see if it had any effect on speech comprehension compared to phonological training. This medication inhibits the hydrolysis of acetylcholine, increasing the availability of this neurotransmitter to the synapses, and enhances cholinergic transmission in the brain (Kumar & Sharma, 2020). Their results showed that phonological training improved speech comprehension and donepezil had no major adverse effects, but it did have some negative effects on speech comprehension. Overall, medications can help, but it is more effective to do more training with clinicians to learn language firsthand. Future studies could try using this drug again because of its positive outcomes in other diseases such as
Alzheimer’s and traumatic brain injuries, but this study did not have the positive effects that were predicted. This medication added to other therapies such as semantic therapy or tDCS could show different results and better improvements of speech comprehension with further studies.

**Discussion**

Both Broca’s area and Wernicke’s area are connected by the arcuate fasciculus in the brain in the left hemisphere, and both are involved in language. Each has a different task in language; therefore, their aphasias have different symptoms and impacts. Broca’s aphasia is a result of damage to Broca’s area in the left hemisphere causing people to lose their ability to form sentences and makes it hard to produce verbs, use pronouns correctly, form a meaningful sentence, produce a well-formed question, but can usually answer yes/no questions, can gain the ability to use verbs and pronouns in the correct form (Grodzinsky & Amunts, 2006). Wernicke’s aphasia is a result of damage to Wernicke’s area in the left hemisphere causing people to have impaired language comprehension, create incorrect responses to linguistic stimuli, often oblivious to their deficiency, have difficulty engaging in language practices, and tend to form non-coherent sentences having rarely anything to do with the subject they are trying to portray (D’Esposito, 2003).

Considering the major differences between these aphasias, their treatments also look considerably different. A key treatment in Broca’s aphasia is melodic intonation therapy. This type of therapy works to make new connections in the brain in the right hemisphere and attempt to repair damage to the Broca’s area by strengthening connections around it. Simply singing also shows improvements in Broca’s aphasia patients as well. Another treatment is conversational therapy treatment in which spontaneous conversation is used to imitate real-life scenarios and
start to form natural reactions to the real world. Both of these treatments focus on allowing the patient to be able to interact in the real world by the treatment having long-lasting effects.

Script training is a way of forming natural sentences by first allowing the patient to learn scripts and cues for situations that may encounter on a day-to-day basis. These are useful because they soon become natural by practicing them and are able to be used for many years to come. The key to making these words and sentences come naturally is by strengthening networks. Another treatment called verb network strengthening treatment works by helping learn specific nouns and verbs and their meanings so the patient can learn to put them together into sentences. By learning the basics, it is easier to apply them to the harder tasks. Speech entrainment also works in this way but helps with fluency and making the sentences make more sense. This type of therapy uses auditory and visual stimuli to help build multiple connections in these patient’s brains. Lastly, electromagnetic articulography is also used with speech language therapy to look into tongue, lip, or jaw movement using low strength magnetic fields to see problems and fix them physiologically. Each of these treatments for Broca’s aphasia works to create networks within the brain to strengthen word finding and sentence forming so that these patients can involve themselves in everyday conversations and be able to interact with the real world.

Treatment for Wernicke’s aphasia are fewer in number seeing as this is a harder aphasia to treat. Situational therapy is a strong therapy in which patients are put into real or simulated situations to imitate real-life conversations or circumstances in which their words and sentences need to make sense. With repeated trial-and-error, improvement is seen long-term for how these patients handle themselves. This treatment is usually not the first to be used though. Semantic therapy is another treatment in which Wernicke’s aphasia patients use that uses mapping with
cues in order to form a generalization. They are given specific cues of words or phrases that after practice, lead to generalizing these to real-world circumstances.

Other treatments include jargon therapy and computerized therapy materials. Jargon therapy helps to work with the words that are not able to be controlled and often are made-up or make no sense. Over time with this treatment, these words tend to make more sense with what the patient is trying to convey, and the actual use of words goes down. Computerized therapy materials are a way for patients to do therapy at home and not with a clinician. These are very self-motivated tasks that show good results as long as the patient wants to learn and follows instruction. Lastly, unlike Broca’s aphasia, Wernicke’s aphasia symptoms can be helped with medication. Phonological training is often improved with medications, but other speech therapies added with it make the improvements the most significant.

There are few treatments that show improvements with both Wernicke’s and Broca’s aphasia patients. One is transcranial direct current stimulation. tDCS is used in Broca’s aphasia on the broca’s area and frontal cortex with significant improvements in articulation and language production. tDCS is used in Wernicke’s aphasia on the wernicke’s area with significant improvements in language comprehension and spontaneous speech. Another treatment used with both aphasias is constraint-induced therapy. Both show significant improvements that are more short-term than long-term but can be paired with other treatments to give long-lasting effects. Both aphasias also use treatments that work with bilingual patients as well, making them more valid and reliable.

Overall, both Broca’s and Wernicke’s aphasia cause language deficiencies that take a lot of time to recover from, and some patients never regain their full language potential back. These treatments often must be combined to have the best overall effect and have to be practiced and
repeated to have long-term effects. In the future, more treatments need to be found in which a bigger difference can be found in a shorter amount of time. These aphasias can be very frustrating for the patients, and therapy in any form that can help them with their everyday language will help them with their mental and physical well-being. There needs to be more research into fast-acting therapies for these patients so that they can regain function in an action people every day take advantage of having.
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