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Clinician's Perceptions of Neurofeedback Application and Effectiveness

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By

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ABSTRACT

Attention Deficit Hyperactivity Disorder (ADHD) affects children and adults alike. Finding an intervention that works for every individual is not an easy task. There is not a one size fits all strategy when considering interventions. Having multiple treatment options available to individuals is important for those diagnosed and affected by the disorder. Many parents are not aware of the attentive interventions available to their children, especially when that intervention is not medication. Dispersing valuable ADHD treatment information to educators and parents is a challenge that would benefit from further research and clinician engagement. In this study, clinicians that provide neurofeedback therapy were asked to complete an online survey pertaining to their perceptions of the effectiveness of neurofeedback treatment. This study obtained valuable information that could aid parents and guardians in providing the best treatment option for their child.

Keywords: attention deficit hyperactivity disorder, neurofeedback, intervention, and treatment

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Attention Deficit Hyperactivity Disorder (ADHD) affects many children in our school systems, and the numbers continue to rise yearly. The American Psychological Association (2020) defines ADHD as a behavioral condition that makes focusing on everyday tasks and routines challenging. Finding a way to improve the quality of life for those affected and diagnosed with ADHD is a vital component of an effective treatment program. There are many interventions used to treat ADHD. The options are as follows: behavioral, cognitive-behavioral, familial, educational, and alternative interventions. Parents and guardians are searching for alternative treatment methods to help their child succeed in academic and non-academic settings since medication can only offer limited support, and for many, medicine is not effective.

ADHD not only affects children at school and at home, but it can also impact their overall happiness. A study conducted by Rogers and Tannock (2013) found that ADHD interferes with the student's basic psychological needs in the classroom environment. Parents want their children to be happy, healthy, and successful, but when a child is diagnosed with ADHD, that vision can seem unobtainable. Finding a solution that works for both the home and school environment is an outcome that parents are diligently trying to discover. Researchers are studying interventions in the lab setting and trying to apply those findings to realistic applications in and out of the classroom. The most common

treatment for ADHD is the use of medication, and it is also considered the most effective treatment (Vitiello, 2008). However, taking medication can have a negative effect on a child. Many medications prescribed to treat ADHD symptoms are classified as Schedule II drugs, which are drugs or substances with a high potential for misuse. These include narcotics, stimulants, and anti-depressants that cause side effects for many children. Side effects include, but are not limited to, insomnia, decreased appetite, mood changes, weight loss, irritability, gastrointestinal disorders, and headaches (Snider et al., 2003). According to the study by Snider et al. (2003), children can also build up a tolerance to the drug over time or the medication can simply have no effect on the child's ADHD symptoms. Teaching a child how to discover interventions they can implement independently is a critical success factor and ensures stakeholder ownership (Miller & Lee, 2013). After determining the cause of ADHD, the student can then be taught skills to reduce their inattention, hyperactivity, and/or impulsivity. By implementing appropriate accommodations and interventions early in the child's life, the challenges of ADHD can be mediated and a promising future is more often obtainable.

A new innovative treatment, known as neurofeedback, is receiving increasing recognition because of the impact that it has on children diagnosed with ADHD. Recent studies have concentrated on neurofeedback and its effectiveness in the reduction of ADHD symptoms (Bakhshayesh et al., 2011). Neurofeedback examines the child's brain waves and provides immediate feedback, empowering them to redirect their attention to the task at hand. An example of neurofeedback therapy could include monitoring a

child's brain wave patterns as the child watches television. As the child's attention diverts, the television programming becomes intermittent and only resumes after the child's full attention has returned. Historical research on the combination of neurofeedback and medication in the successful treatment of ADHD has proven to be clinically significant. Thus, future research is needed to substantiate the lifelong benefits of using neurofeedback, independently of medication (Gevensleben et al., 2010; Snider et al., 2003). Involving the child as an active participant in using neurofeedback, should theoretically reduce the need for medications, and therefore reduce negative side effects and improve quality of life. The purpose of this study is to investigate clinicians' perceptions of neurofeedback and to increase awareness of this treatment option in the community.

Chapter II

Literature Review

Attention Deficit-Hyperactivity Disorder

Attention Deficit Hyperactivity Disorder (ADHD) is visible in many environments and each individual can display symptoms differently. It was estimated in 2016 that nearly 6.1 million children have been diagnosed with ADHD (Danielson et al., 2018). With this condition affecting so many individuals, it is imperative that all disciplines be vigilant in discovering a successful treatment plan. Although ADHD can be seen in any environment, educators are seeing an increase in negative behaviors related to ADHD in the classroom. These behaviors impact self-esteem, social relationships, and academic performance.

Manifestations of ADHD

ADHD can manifest itself in various forms including hyperactivity/impulsivity, inattention, or a combination of the two forms. Educators and parents need to understand exactly how ADHD may display itself both inside and outside of the academic setting. The classroom can be a demanding environment especially for a child diagnosed with ADHD. Symptoms range from being off-task and shorter attention spans to constant interrupting and continuous ambulation. Hyperactivity/impulsivity may manifest itself in individuals as extreme restlessness, fidgeting, difficulty taking turns, and often times shouting out answers or random comments at inappropriate times (Quinn & Wigal,

2004). The child may display behaviors such as tapping a pencil, fidgeting, and/or talking constantly. Inattentive ADHD manifests itself as forgetfulness, disengagement, or distractibility and is often misdiagnosed as anxiety or a mood disorder (Quinn & Wigal, 2004). An individual may act quickly without consideration of consequences or act inappropriate in social situations. ADHD can negatively impact social adaption, educational attainment, and quality of life (Gevensleben et al., 2012). In a classroom environment, it can be very difficult for these children to concentrate on tasks because of their short attention span. This is a concern for teachers because it can impact the entire classroom. If researchers can determine how to appropriately intervene in each individual case of hyperactivity/impulsivity, inattention, or a combination of these manifestations, this will aid in ensuring improved self-esteem, social relationships, and academic success.

Interventions for ADHD

Cho and Blair (2017) attempted to apply a multicomponent, function-based intervention in the classroom to determine if the results would show an increase in desirable classroom behaviors for students with ADHD. A core value of function-based intervention is to build collaborative partnerships among teachers, students, and their families in designing behavior support plans, and sharing responsibility for interventions (Carr et al., 2002; Horner, 2000). A multicomponent function-based intervention consists of preventative strategies, other proven strategies, and instruction for educators, parents, and students on how to implement them successfully. Most of the time, teachers

involved in the intervention process, do not know where to begin or how to positively impact a student with ADHD. In this particular study researchers evaluated the following preventive strategies:

- Giving frequent breaks
- Breaking activities into smaller steps
- Assigning strategic seating arrangements
- Reviewing daily schedules
- Giving a countdown when changing activities
- Providing choices, or a cool-off place

Other proven strategies included:

- Self-monitoring and teaching students how to complete tasks independently
- Impulse control using a cue card "slow down, think" on one side and "stop" on the other side
- Teaching students to raise their hand instead of blurting out
- Giving positive feedback regularly
- Ignoring problem behaviors

More importantly the study focused on whether or not teachers and parents could implement the appropriate interventions with consistency. Staying consistent across all environments should assist students in showing improvement both behaviorally and academically. Equipping teachers and parents with effective intervention strategies that can be easily implemented in different environments should guarantee the greatest

opportunity for success. The study conducted by Cho and Blair (2017), using multicomponent function-based interventions, confirmed their hypothesis that implementing preventive strategies decreased problem behaviors and increased academic engagement.

Martin (2012) documented that the use of personal best goals improves classroom behaviors. His study supported the hypothesis that when students are given the opportunity to contribute to the development of their goals there is a positive correlation between development and accomplishment. This correlation can be true for students with, or without, an ADHD diagnosis. The pursuit of personal best goals appears to be a promising approach to promoting the academic potential of diverse groups of learners. Applying this multi-modal approach to ADHD should support substantial improvement in many facets of the lives of students struggling with ADHD.

Rogers and Tannock (2013) also studied the differences among children with, and without, symptoms of ADHD in the classroom, with special emphasis on the role of the teacher. The study proposed that ADHD symptoms could have a negative impact on the child's fulfillment of basic psychological needs in the classroom. Basic psychological needs include: autonomy, relatedness, and competence. Autonomy, according to the study, is the child's natural desire to experience their learning and behavior as they determine. Successful relatedness means a child is happy and content with their school experience. Competence refers to a child's determination to feel successful and able to perform their classroom activities. The modifying factor of this negative impact is the

role that the teacher plays in making the child feel cared for and important. Teachers play a vital role when it comes to the success or failure of a student with ADHD in the classroom. A positive relationship is critical if the student is to succeed. Because of the correlation between student achievement and teacher competence in regards to ADHD, it is key that educators and parents stay informed and up to date about successful ADHD interventions. Educators play an important role in the referral process for services to address ADHD. Timely access to appropriate resources facilitates early interventions and contributes to the overall well-being and success of the student.

Early intervention strategies are crucial to support families and children diagnosed with ADHD (Gevensleben et al., 2012). A strong collaboration between families and schools positively impacts children in home and academic environments. Multiple studies have supported the benefits of early identification of ADHD allowing headway to be made before other comorbid conditions limit progress (Halperin et al., 2012).

Snider et al. (2003) found that teachers should have additional training and information pertaining to ADHD, including medications that are commonly prescribed. By encouraging teachers to be observant for specific behaviors, they can collaborate with parents and physicians to develop an appropriate treatment plan. Teachers enrolled in the study, agreed that they need more information on alternative interventions. If educators, parents, and students are unable to work together to support students diagnosed with ADHD there is a potential risk for academic delays (Steiner et al., 2014). Rogers and Tannock (2013) support the findings that adolescents experiencing a lifelong struggle

with ADHD have more negative academic outcomes than their non-ADHD peers. This research corresponds to all academic areas including reading, writing, and math.

According to Vile Junod et al. (2006), students diagnosed with ADHD need to engage in instructional strategies and activities that afford them multiple modalities to actively engage in learning. Sullivan-Carr (2017) suggested that game-based learning is an effective way to accommodate students with ADHD symptoms. When game-based learning is paired with classroom instruction academic achievement increases for ADHD students. Teachers and students have both stated that they felt game-based learning had a positive impact on their classroom achievement. Game-based learning, as a component of neurofeedback has been proven to increase attentiveness and decrease hyperactivity/impulsivity. Class wide peer tutoring is another effective instructional strategy in children with ADHD. It is a form of collaborative learning between students of similar academic backgrounds with interchanging roles of tutor and learner. Another teaching method proven to be extremely successful in children with ADHD is kinesthetic learning. A kinesthetic learner may appear highly active and anxious. These students enjoy being physically involved in the assignment. Hands-on teaching works best for kinesthetic learners. Examples include science labs, experiments, field trips, crafts, and plays (Lockhart, 2021).

Gender Significance in ADHD

Findings from a study by Quinn and Wigal (2004), also indicated that gender does play an important role in the diagnosis and treatment of ADHD. Knowing the signs and

symptoms to look for specifically in girls vs. boys enables the teacher to provide appropriate early interventions. Whether the ADHD behaviors are displayed externally or internally will depend on the gender and age of the individual (Mano et al., 2017). While preadolescent girls display internalizing signs of ADHD, boys at that age display externalizing signs. Evidence shows a switch in displayed behaviors once adolescence is reached. Understanding this reversal phenomenon promotes improved outcomes for both genders.

Neurofeedback Therapy

Neurofeedback is a behavior therapy that trains participants on how to learn and/or improve self-regulation of brain activity. It specifically focuses on a child's brain electrical activity arrangements indicating attentional processes and executive functioning (Gevensleben et al., 2012). Neurofeedback began in 1976 with Shouse and Lubar, who discovered significant increases in IQ and behavioral improvements in an A-B-A-B research design (Arnold et al., 2013). During a neurofeedback session, the client will wear a tightly fitted cap with electrodes to measure the strength of frequency waves such as beta, alpha, theta, delta, and gamma in cycles per second or hertz (Hz; Cleary, 2011). While wearing the cap, the client may be asked to do various tasks such as sit still, open their eyes, or close them. While conducting a neurofeedback session, a client discovers how to control their brainwave activity to display a video, hear a song, or play a video game. The brain discovers the correct frequencies that will allow the video or game to play continuously. If attention diverts and the client does not display the appropriate

brain frequencies, the video or game will not be able to be seen or played. Neurofeedback teaches the student how to maintain the ideal electroencephalogram (EEG) arrangements. This allows the student to be more conscious of what is required to sustain attention (Lansbergen et al., 2011). The key focus of neurofeedback should be on the client and their ability to transition the lab based skill to their daily life. Moriyama et al. (2012) observed that particular EEG frequency patterns are associated with certain brain activities. Slow-frequency waves are associated with resting states and faster waves are related to the brain performing a task. From these findings, researchers can begin to associate specific brainwave frequencies with behaviors and then target those particular behaviors. Neurofeedback therapy is a promising alternative treatment for ADHD and warrants further consideration.

Neurofeedback and ADHD

Neurofeedback has been proven to provide long-term benefits after successful completion of treatment for those diagnosed with ADHD, according to Holtmann et al., (2014). This cognitive and behavioral technique can re-train the brains of children and adults. This means that when a brain of an ADHD patient is compared to a non-ADHD patient abnormal brainwaves are visible either in shortage or overload (Peniston & Kulkosky, 1989). For a client diagnosed with ADHD, one would normally display an abundance of theta activity during a reading task. This increase in theta activity would manifest itself as signs of daydreaming and a lack of focus. Which is normal for a child diagnosed with ADHD (Cleary, 2011). Of the studies that have been published most

have found that the effects of neurofeedback are comparable to that of medication on measures of inattention and impulsivity (Arns et al., 2014). Further evidence discovered by Gevensleben et al. (2009) also proves that EEG pattern modification using neurofeedback for theta/beta and slow cortical potentials (SCP) can lead to behavioral improvements in students with ADHD. According to a study conducted in 2012 by Moriyama et al., neurofeedback showed promising results for the long-term effects. Neurofeedback studies have proven to be more reliable when the studies are blinded. When the participant involved in the study is unaware of the treatment they are receiving, they rated their attention and hyperactivity as improved (Bakhshayesh et al., 2011). Another neurofeedback study used a double-blind placebo effect to determine if the results would also show an improvement in individuals diagnosed with ADHD. Findings support the hypothesis that it is possible to utilize a placebo-controlled investigation, however; the use of a double-blind design may not be supported because automatically adjusted reward thresholds may not work as well as manual thresholds (Lansbergen et al., 2011). Although the Lansbergen et al. (2011) study suggested that one could not have a double-blind design, other researchers have found that it is a possibility. Arnold et al. (2013) showed significant findings that indicate it is feasible to have a credible double-blinded neurofeedback trial. Their study focused on two groups, each attending neurofeedback sessions. One group went two times a week, and the other group three times a week. Parent ratings indicated that approximately 24 treatments were needed to

see significant results. This pilot study needs to be further investigated to duplicate these findings and then expand the research to a larger sample size.

Neurofeedback is a relatively new treatment method, and there are only a few studies conducted to further support the findings. In the numerous studies that were identified in this paper, each study reported needing more evidence to support the positive findings. However, until more significant research can be conducted to support the use of neurofeedback therapy, it remains a viable alternative treatment with a proven positive impact on ADHD symptoms.

Mechanisms linked to Neurofeedback

Research has provided significant findings to support alternative interventions to medications when treating ADHD symptoms. One of those alternative methods is to utilize a Quantitative Electroencephalography (QEEG) to study attention factors to assess for student's potential changes in brain waves.

To be more specific, a QEEG monitors brain activity, which is then converted into a digital assessment. Electrodes are placed on the scalp of a client to identify the microvolt-sized signals that come from synchronized neuronal activity within the brain. Once these signals have been recorded, researchers use advanced arithmetical techniques to determine if any patterns are present that would otherwise be unnoticed by a researcher (Kader et al., 2015). The findings are then displayed using a topographical diagram representing electrical activity of the brain, also called "brain maps". The electrodes are positioned on an individual's head in accordance with the International 10/20 System

(See Figure 1). The International 10/20 System utilizes a range of 20 – 150 UV peak to peak over a 0.5 – 60 Hz bandwidth. A QEEG can provide valuable information about the functions of a brain specifically in ADHD students when examining the frontal areas without causing intrusive complications for the individual (Roh et al., 2015). In clients with ADHD the researcher will routinely see a high theta/beta ratio, or high theta power and/or low beta power in children and adults. Theta (4 – 7 Hz) and Beta (13 – 30 Hz) bands of the power spectrum measure observation and attention and correlate to observable behavior. Theta levels are negatively associated with attention and high theta is associated with a distracted state. In comparison, beta levels are positively associated with attention, and lower beta is associated with a distracted state. Research has found that when examining the brain of an ADHD patient there will be higher theta/beta ratio in the frontal area, which could aid in the identification of ADHD (Kader et al., 2015).

Figure 1

Electrode Placements

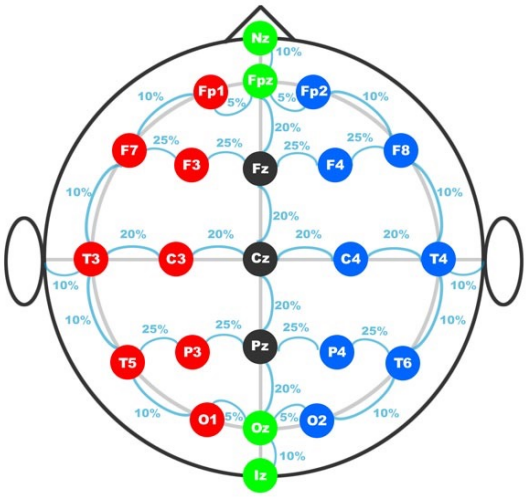

Figure 1. Electrode placements in the International 10/20 electrode system. (Fp=front polar; C=central; P=parietal; F=frontal; O=occipital). Adapted from "10/20 System Positioning Manual" by Trans Cranial Technologies ltd., 2012, p. 2.

The International 10/20 System was finalized by Jasper in 1958. Instead of using absolute measurements, the new system uses percentages. By positioning the magnetic coil in dependable areas in the cortex region, they can influence the limited neuronal activity by the electromagnetic field (Herwig et al., 2003). The electrodes are categorized according to brain area and identified with the first letter of that area (O for occipital, P for parietal, C for central, T for temporal, F for frontal, and Fp for front polar; the earlobes are labeled with an A). Even numbers are given to the electrodes located in the right hemisphere, and odd numbers are for the left hemisphere. Lastly, "Z" for zero is given to electrodes assigned to the midline.

When examining EEG measurements, there is a close connection between arousal state and EEG frequency. Four EEG frequencies have been identified: Alpha, Delta, Theta, and Beta. Studies indicate that what an individual is doing or feeling will correspond to brain waves that are measured in hertz (cycles per second). Alpha waves (8 to 12 Hz) are the conscious but resting state of the brain. These waves help with overall mental coordination, calmness, alertness, and learning. Delta waves are slow, less than 3 Hz activity, found in deep meditation or sleep. Delta waves aid in empathy and are essential to the healing process. Theta brainwaves are present most in sleep, but also during deep mediation. Learning methodologies, memory utilization, and intuition are controlled by the theta brain wave frequency. This frequency also controls the state of our dreams and imagination. Another brain wave, beta, is from 12 to 38 Hz. These waves are present in the normal awake state of consciousness when it is highly important to engage in cognitive tasks. While awake, children and adults must be actively engaged in problem solving, decision-making, and possess the ability to stay focused. Overstimulation can lead to an increase in the number of beta waves and can be linked to anxiety disorders, sleep problems, and depression. While under-stimulation can be linked to insomnia, depression, and attention deficit. A combination of over and under-stimulation can be displayed in cases of ADHD. Participants with ADHD display less beta activity and an excessive amount of slow waves in the frontal parts of the brain than their same-age peers (Chabot et al., 2001). Depending on the subtype of ADHD diagnosed, the client can display very individualized brain wave patterns. An individual

with inattention will could display excess theta brain waves. Hyperactivity can be displayed as excess alpha waves, and impulsivity might be displayed through excess beta waves (Hammond, 2010). Individuals diagnosed with various disorders (anxiety, depression, post-traumatic stress disorder, head injuries) can also be studied using the imaging techniques of a QEEG (Hammond, 2005).

The main focus of QEEG in a study by Arns et al. (2012), was to develop individualized neurofeedback protocols based on EEG patterns. The study found that each QEEG pattern represented an ADHD symptom including inattention, hyperactivity/impulsivity, and depression. Individualizing interventions to align with a child's presentation of symptoms is the goal of educators, professionals, and physicians (Donald et al., 2014). Considerable information can be gathered from years of research to aid in developing classroom interventions. However, according to Martin and Konopka (2011), additional studies are needed to generalize findings from the clinical setting to everyday life. There is valuable research to support that EEG-neurofeedback provides a promising alternative to medication without adverse effects (Lansbergen et al., 2011). The ability to visualize the abnormal brain wave patterns that children with ADHD display can further enhance research by allowing practitioners to concentrate on those particular brain waves to improve and customize interventions and treatment protocols.

Neurofeedback Protocols for ADHD

Protocols are a set of controls that determine how neurofeedback therapy is conducted. They include enhancement and inhibition, decision criteria, feedback signals, threshold adjustments, and training decision points. Numerous protocols have been applied to neurofeedback in the treatment of ADHD. In a study performed by Mohagheghi et al. (2017), researchers investigated two different protocols for clinical and cognitive symptoms of ADHD. The first protocol was theta suppression and beta enhancement, while the second consisted of theta suppression and alpha enhancement. Both protocols showed findings that supported the hypothesis that neurofeedback would decrease ADHD symptoms. The alpha enhancement protocol showed a greater increase in the suppression of omission errors even after an eight-week, intervention-free, time period. Both of these protocols supported findings demonstrating that it is possible to improve attention spans and decrease hyperactive symptoms. In a study by Bakhshayesh et al. (2011), research focused on placement of the electrodes on CPz and FCz areas of the brain. This frontal area is associated with attention, impulse control, problem solving, and social interaction. Other studies focus electrode placement on the central areas of the brain that control high-order brain functions such as sensation, perceptions, memory, association, thought, and voluntary physical action (Arnold et al., 2013). Many studies agree that no specific protocol is more beneficial than another, but most studies used a 'standard' neurofeedback protocol. The standard neurofeedback protocol consisted of theta/beta and theta/SMR (sensorimotor rhythm) training and decreasing theta and

increasing beta waves and SMR. Studies also investigated slow cortical potential training (SCP) by changing positive and negative SCPs (Van Doren et al., 2017). SCP training focuses on the control of phasic cortical excitability to enhance allocation of cortical resources. When there are negative SCP's there is an increased excitation, mainly during behavioral or cognitive preparation. Positive SCPs show a decrease of the cortical excitation of the underlying neural networks, like behavioral inhibition. This phenomenon was demonstrated in a study by Birbaumer et al. (1990). This study proves that when neurofeedback is adapted to SCP changes the results are nonspecific phasic alertness, along with effects at the behavioral performance level (Gevensleben et al., 2012). However, further research is still needed to conclude that altering neurophysiological processes help inhibit a specific symptom. There are many subtypes of ADHD; therefore researching different areas of the brain and corresponding EEG patterns changes is a top priority for research.

Neurofeedback Sessions for ADHD

Studies are also attempting to determine how many neurofeedback sessions are needed to produce the desired results and what the duration of each session should be. In a study conducted by Arnold et al. (2013), they compared the benefits of sessions two times a week versus three times a week. Results suggested that individuals preferred three times a week so that the duration of the trial could be shortened. This option would minimize expenses for all parties involved and allow more individuals to participate during the school year. The number of required treatments was also investigated, and it

was concluded that at approximately treatment 24, the effectiveness of the treatments began to plateau. This conclusion supports the hypothesis that about 24 treatments are ideal to see maximum improvement of symptoms. By finding the ideal number of sessions for ADHD individuals, it will be helpful in allowing the child to transfer this lab training to the classroom environment as early as possible.

Studies utilizing Neurofeedback for ADHD

Many studies have been conducted over the years, and many beneficial results have been discovered to help those with ADHD symptoms. In an article by Moriyama et al. (2012), researchers investigated neurofeedback and its use as an alternative treatment. They concluded that neurofeedback is beneficial in the treatment of ADHD. Neurofeedback displays promising results for long-term modification of ADHD symptoms when the participant actively participates and engages in behavior modification.

Neurofeedback Studies with Unblinded Participants

A study by Gevensleben et al. (2010), examined the impact of a combined theta/beta and slow cortical potentials (SCP) training on the spontaneous EEG, in comparison to attention skills training. It was hypothesized that there would be a decrease in theta activity and an increase of beta activity after neurofeedback. The study also examined the correlation between changes in EEG patterns and behavioral improvements. Using 36 neurofeedback and attention skills training sessions for duration of 50 minutes each, they tested their hypothesis. The findings minimally supported the

assumptions of the effects of neurofeedback training on the resting EEG. However, some specific EEG patterns were substantially altered after neurofeedback. EEG patterns for theta/beta and SCP training showed proof that neuronal mechanism changes contribute to similar behavioral and cognitive improvements in children with ADHD.

A study conducted by Bakhshayesh et al. (2011) attempted to control for unspecific effects and confounding variables. Their goal was to control for motivational aspects by using the same immediate feedback order. It was hypothesized that progress in the neurofeedback group would be greater than the treatment effects in the control group in relation to behavioral changes and improved cognitive achievement. The study hypothesized that participants getting neurofeedback training would improve their ability to control their cortical activation over time. Participants showing decreased activity in the theta band waves and increased activity in the beta band waves would test this hypothesis. There were two groups, 30 sessions, held 2-3 times a week, and lasting 10-15 weeks. A psychotherapist also met with the parents twice a month to provide counseling support. Children were taught to play three different games and appropriate behaviors were reinforced utilizing smiley-faced vouchers. In this same study, neurofeedback training was compared to EMG biofeedback training in children with hyperkinetic disorders. The parents of the neurofeedback group, when compared to the biofeedback group, rated improvement of attention and hyperactivity higher. This study showed that neurofeedback improved hyperkinetic symptoms in general, but more research needs to be conducted to determine if neurofeedback is superior to EMG

biofeedback. These studies supported the hypothesis that neurofeedback allows the developing brain to show signs of neuroplasticity, which strengthen neuronal networks (Gevensleben et al., 2012). In these three studies the participants had knowledge of the research group they were assigned to. The question remains unanswered as to whether participants in a blinded study would report similar benefits of neurofeedback.

Neurofeedback Studies with Sham and Blinded Participants

A double-blinded sham-controlled trial of neurofeedback therapy on children, 6 to 12 years old, attempted to answer the following questions based on a review of current evidence: a) Is it feasible to conduct a double-blind, sham-controlled design?, b) Does the number of treatment options: two versus three treatments per week make a difference?, and c) What are the necessary number of treatments? (Arnold et al., 2013). Assessing the changes in ADHD symptoms for two groups two times a week versus three times a week tested the effectiveness of the treatment protocol. The findings indicated that it is possible to do a placebo-controlled study to research the efficacy of neurofeedback in ADHD. However, most parents indicated that their children in the neurofeedback group thought they had been placed in the placebo group.

The three feasibility questions of this study were successfully answered.

1. It is possible to conduct a double blind neurofeedback trial with adequate recruitment and retention and successful blinding of parents and children.
2. The clear answer to the desirable treatment frequency was three times a week.

3. The duration of treatment should be 24 sessions based on symptom improvement plateaus.

This study supports the need for a larger study using sham control of the same intensity and duration.

A study by Lansbergen et al. (2011) attempted to determine if it was practical and ethical to use a double-blind placebo feedback-controlled design to measure the effects of individualized neurofeedback training in children with ADHD. Children were then assigned blindly to one of two groups: (1) EEG-neurofeedback or (2) placebo feedback. All 14 children with ADHD in both groups completed the study. The findings from this study state that it is possible to conduct a placebo-controlled investigation, but a double-blind design may not be reliable because the automatically adjusted reward thresholds may not work as well as the manual thresholds. There are numerous studies that display similar results, thus leading to the conclusion that more research needs to be conducted in the field of neurofeedback therapy as it is recognized as a viable and effective treatment for children with ADHD.

Parents Perceptions of ADHD and Neurofeedback

Parents are the determining factor when it comes to decisions that are made affecting their child diagnosed with ADHD. Many depend on physicians, educators, family, and friends to make their decisions without doing their own research. Parents of children with ADHD know that a simple solution does not exist, so finding an effective treatment option is key to success. A study by Hart et al. (2018) found that only 45% of

parents were open to the use of medications to treat their child's ADHD symptoms. Over 50% of parents did not want to use medication due to its side effects and limited effectiveness. The current study aims to understand parent perceptions and knowledge about neurofeedback and how to increase awareness of this treatment option. When parents are given the appropriate and relevant information regarding ADHD and alternative interventions/treatments for their child they can make a decision that best meets their objectives. Living with, and raising, a child with ADHD is difficult for everyone in the home and patience is constantly tested (Molina & Musich, 2016). Research determined that the best treatment plan for ADHD children is help, guidance, and understanding from their parents and educators. Most parents and educators are not aware of the multiple educational and/or behavioral interventions available (McGuinness, 2008). There is disproportion between diagnosis and intervention options for those with limited resources and those who live in rural settings (Knopf, 2018). Providing treatment options to parents in rural communities should be a top priority for physicians and school educators. Treatment and intervention options differ depending on the age of the child (Knopf, 2018). This means that an intervention or treatment that may work for a preschool child may not be appropriate for a high school child. For this reason, it is important that everyone involved with a child that has been diagnosed with ADHD is aware of relevant research and findings.

Many parents believe that their only treatment option is medication, but medication is not always appropriate (Stroh et al., 2008). Research from these studies

has concentrated on parent perceptions of ideas and satisfaction with medication, not on how knowledgeable they are on ADHD treatments and interventions. More and more parents over the years are trying to find alternative treatment options instead of medication because of the over-prescribed use and negative side effects that ADHD medications offer (Stroh et al., 2008). From this study, one of the main limitations, are parents making inaccurate judgments on treatments for their child based on misinformation and beliefs. The other is that parents are relying on information from other groups of people that are biased toward a particular treatment option. Learning about limitations from particular studies is what this study aims to discover. How can educators and physicians provide more useful and unbiased information out to parents and themselves? To answer this question research must look toward clinicians that offer neurofeedback therapy to clients.

Study Rationale and Research Questions

Using neurofeedback to treat ADHD symptoms can be a beneficial intervention that far exceeds that of medication. Therefore, it is important to understand the perception of neurofeedback from the clinician perspective. Public awareness of alternative treatment options is also imperative to ensure that each child has the best possible treatment outcome. Discovering where the lack of information is requires the current study to ask clinicians providing neurofeedback therapy to describe their perception of neurofeedback and its effectiveness.

The current study examined the perceptions that clinicians have of neurofeedback through the use of an open and closed question survey. By consulting with clinicians that offer this intervention, insight will be gained on how to distribute information about neurofeedback to educators and parents. After wide distribution of educational materials, theoretically, a student diagnosed with ADHD should have broader selection of treatment options and a brighter future. The goal of the current study is to answer the following research questions:

1. What are clinicians' perceptions about neurofeedback as an effective intervention for children diagnosed with Attention Deficit Hyperactivity Disorder?
2. How can information about neurofeedback be more efficiently provided to parents and educators?

Chapter III

Method

Participants

Participants in this study consisted of clinicians' who were knowledgeable, properly trained, and currently providing neurofeedback as a method of therapy. Participants were identified, through the Psychology Today website and the Biofeedback Certification International Alliance website. An email was sent with a link for the survey inviting clinicians to participate. Data was collected from 13 clinicians across the state of Texas, however two participants did not complete the entire survey. One participant completed 42.3% of the survey, while the other participant completed only 26.9%. There were four male and seven female clinicians that completed the survey in its entirety. Clinicians practicing in North Texas represented 63.6%, 9.1% in East Texas, 18.2% in South Texas, and 9.1% in Central Texas.

Materials and Procedures

The participants completed a survey through the online program Qualtrics. Out of the participants, 12 were sent an anonymous link and two were emailed the survey link. The link connected the participants to the Qualtrics website. Before starting the survey, informed consent was obtained and a qualifying question to ensure that participation was from an individual currently providing neurofeedback to clients. The researcher-

developed survey included 26 questions comprised of 12 close-ended questions and 14 open-ended questions, broken down into three sections. The average time of completion was 52.2 minutes. The first section aimed at collecting basic information from clinicians that perform neurofeedback to clients while using categorical data represented through percentages. Section two consisted of open-ended questions concerning clinicians' role and opinion of neurofeedback. By examining answers from questions 12-20 themes were condensed into categories to better analyze the data. The last section asked clinicians to provide basic demographic information. Information obtained in this section allowed for better understanding of who and where neurofeedback was provided.

Table 1.

Sample of survey questions

Part I

1. Do you currently conduct neurofeedback therapy for clients?
2. Do you treat children and/or adults?
3. What percentage of therapy is neurofeedback in your clinic?
4. What condition(s) do you treat with neurofeedback?
5. What protocols do you use?
6. What equipment is necessary for neurofeedback sessions?
7. How long are neurofeedback sessions?
8. What is the number of neurofeedback sessions before improvement is seen?
9. Which electrodes do you use while performing neurofeedback sessions?
10. What frequencies do you use?
11. Are medications usually prescribed along with neurofeedback?

Part II

12. Please explain what a typical neurofeedback session looks like?
13. What training do you need to perform neurofeedback sessions?
14. Why do you think neurofeedback is a better intervention than other interventions?
15. How are your clients referred to you?
16. What is the role of the parent/caregiver when a client receives neurofeedback?
17. What is the best way for parents to learn about neurofeedback? How can awareness be increased?
18. What are some advantages of neurofeedback?
19. What are the main obstacles in efficiently providing neurofeedback to clients?
20. In your opinion, why so some individuals stop the neurofeedback therapy before they complete sessions?

Part III

21. What is your age range?
22. What is your gender?
23. What is your highest level of education?
24. What region of Texas do you work in?
25. How long have you provided neurofeedback sessions?
26. Any additional comments.

Design & Analysis

A qualitative study design was implemented to gain insight, and explore the depth and complexity of neurofeedback. It was also intended to provide a better understanding of neurofeedback from a clinician's perspective. The qualitative study analysis consisted of examining survey questions separately to analyze the answers of each participant, through descriptive statistics. A combination of descriptive statistics and categorical data were used to understand the research findings. The study examined the participants' answers at the precise point the survey was completed. Mental health clinicians, identified through web searches, were sought out to participate in the study. Each participant was given a non-identifying number to track their answers on the survey questions. Close-ended questions were analyzed using descriptive statistics and categorical data. Open-ended questions were coded for qualitative analysis using themes such as: neurofeedback sessions, necessary education, benefits, role of caregivers, awareness, obstacles, and not completing therapy. The open-ended questions were analyzed using an Excel document to maintain the data in an organized format. Categories were identified upon completion of data collection and careful analysis was conducted to form the analysis section. Each question provided similar groupings allowing for themes to be combined into smaller categories to code for explanation of results. Once complete, clinicians' perspective on properly providing neurofeedback resources to the community could be determined. The last section focused on the demographics of participants by applying descriptive statistics. Demographics were

important providing the study with data to further support the proposed research questions. The results were communicated with clear, reasonable, and purposeful analysis.

Chapter IV

Results

Thirteen clinicians completed the survey however, only 11 clinicians completed all 26 questions. One clinician answered questions one through 11, but failed to answer questions 12 through 26. The other participant that did not answer all questions, failed to answer questions five, six, nine, 10, and 11 through 26. For participants who did not answer all of the survey questions, only available answers were included.

Percentage of Time Providing Neurofeedback

Information was provided by participants concerning how much time each spent conducting neurofeedback therapy in their practice. Four participants indicated that 0-20% of their practice consisted of neurofeedback therapy. One participant indicated that 21-40% of neurofeedback represented their practice, another responded 41-60%, one clinician reported that 61-80%, and six responded that 81-100% of their practice was spent providing neurofeedback therapy. Seven participating clinicians spent over 50% their time and six spent under 50% of their time practicing neurofeedback therapy with clients. Based on findings from this study, neurofeedback therapy was a beneficial alternative to medication, focusing on a larger percentage of therapy time on neurofeedback would provide improved outcomes for patients.

Conditions

Neurofeedback is used by 100% of the clinicians in the study to treat ADHD/ADD and Anxiety/Depression symptoms. Clinicians also provide neurofeedback therapy for Autism (73%) and other disorders such as post-traumatic stress disorder (PTSD), Traumatic Brain Injury (TBI), substance abuse, and trauma. PTSD and TBI were treated by 27% of neurofeedback clinicians, and 18% treated substance abuse and trauma. Other conditions treated by neurofeedback include: cognitive decline, migraines, memory, peak performance, and/or sleep issues. The vast majority of neurofeedback clinicians, most commonly treat, ADHD/ADD and Anxiety/Depression, Autism is the next most common psychopathology treated with neurofeedback therapy. As more evidenced based information becomes available regarding neurofeedback, indications for its use will inevitably expand.

Protocols and Equipment

Neurofeedback therapy can be categorized using methodology. This methodology can be divided into two categories: 1) QEEG based protocols or 2) neurofeedback only protocols. Study data was analyzed based on responses to questions related to protocols and equipment. There are two clinicians that currently implement neurofeedback only protocols in practice, while 10 clinicians use QEEG based protocols. Neurofeedback only protocols consist of amplitude training or CZ, T4-P4, Alpha, and Theta. Other clinicians use QEEG based protocols such as: Z-score, S-LORETA, QEEG guided, Neurofield, and Neuroguide, which provide the most current evidence-based

therapy. Two clinicians are using equipment labeled as neurofeedback only and the other nine clinicians currently use QEEG based equipment. Carefully selected protocols and equipment provide critical information for the clinician to better treat their patients. Clinicians in this study are using advanced technology data, as evidenced by more clinicians using QEEG based materials than neurofeedback alone.

Table 2.
Protocols and Equipment Necessary for Neurofeedback Sessions

	Necessary Protocols		Necessary Equipment	
Respondent	Neurofeedback Only Protocols	QEEG Based Protocols	Neurofeedback Only Equipment	QEEG Based Equipment
1	X		X	
2		X	X	
3		X		X
4	X			
5		X		X
6		X		X
7				
8		X		X
9		X		X
10		X		X
11		X		X
12		X		X
13		X		X

Sessions

Clinicians were surveyed regarding the recommended length of each session and number of sessions necessary to witness symptom improvement. Twelve of the 13 participants agreed that the greatest benefit was achieved during sessions lasting 15 – 30 minutes or 31 – 45 minutes. Only one participant stated that for the session to be effective, 45 plus minutes was needed. All clinicians agreed that to see improved symptoms either 5-10 (38.46%) or 11-20 (61.53%) sessions are required. Patients seek neurofeedback therapy as an alternative to medication, and the research study supports that statement. Nine participants responded that their clients' do not take medication in combination with neurofeedback. Three clinicians stated that clients are taking medication in conjunction with neurofeedback therapy, and one clinician was unsure if their clients took medication. An important finding of this study was that the length of time for each session was critical to the success of the client, as well as the number of sessions needed before improvement was visualized.

Referrals

The second research question addressed by this research study was whether or not information regarding neurofeedback could be more efficiently provided to parents and educators. The data identified by nine out of 13 clinicians indicated that most referrals come from previous clients of neurofeedback therapy. Seven of the 13 indicated that other clinicians or doctors referred clients. Three out of 13 clinicians indicated that clients were referred through Internet searches. Only one clinician stated advertising

allowed them to gain more clients. Based on this research study, client testimonials are the most efficient way to provide parents and educators with information related to neurofeedback and the associated benefits.

Demographics

Demographic information from neurofeedback clinicians was also collected. Gender data showed that four males and seven females completed the survey. The ages ranged from 20 to 75 years. There were four participants in the age group of 20-30, two in groups 31-45 and 46-60 years, and three in the age group of 61-75 years. Most clinicians held a Master's degree, 72.7% as opposed to that of a Doctoral degree, which represented only 27.2%. Years of experience providing neurofeedback to clients ranged from 30 years to less than five years. Data represented that 36.6% of neurofeedback providers have been providing the therapy for 0-10 years, 18.2% have provided neurofeedback for 11-20 years, and only one has been providing therapy for 21-30 years. An additional question on the survey was in which area of Texas was the service was provided. Neurofeedback providers practicing in North Texas represented 63.6%, 9.1% in East Texas, 18.2% in South Texas, and 9.1% in Central Texas. Most clinicians have a Master's degree, and they are providing therapy to the larger cities in North Texas.

Detailed Analysis

Nine questions were analyzed using a detailed investigation of each question. The results were presented in detailed form by combining similar answers to identify

themes and then transition those themes into categories. Each answer was individually grouped to paint a clear picture regarding treatment perceptions of neurofeedback clinicians and how to best provide that information to parents and educators. This analysis allowed the examination of individual feedback from the participants upon completion of the study.

Necessary Education to Provide Neurofeedback Therapy

Training must be completed prior to clinicians providing neurofeedback as an intervention. Approximately half of the participants stated that prior education was necessary to implement neurofeedback. According to the Biofeedback Certification International Alliance (BCIA) website, professionals seeking to become certified must have completed a Bachelor of Arts or Bachelor of Science degree from a clinical health care area of study. There are many degrees listed in health care areas, but if no degree is held then the role of Technician Level Certification may be an option. In order to provide neurofeedback a certification through the BCIA or another professionally certified organization is encouraged. Those that want to provide neurofeedback must participate in a mentorship program. This allows the trainee to have a mentor that can aid in strengthening their knowledge and experience through field training.

Table 3.

Necessary Education to Provide Neurofeedback Therapy

Themes	Participants	Percentage
Education		
Undergraduate	3	27%
Other professions	3	27%
Certifications		
BCIA	6	55%
Other	6	55%
Experience		
Session practice	3	27%
Mentorship	6	55%

Neurofeedback Awareness

The themes identified in the survey question related to how to increase awareness of neurofeedback therapy were research and communication, and were agreed upon by 10 of the 11 participants. Under the theme of research the responses were divided into categories: articles (45%), conferences (18%), and technology (27%). The other theme was communication; eight of the 11 participants reported this theme. The categories of communication were family/friends, pediatricians, and therapists. Family and friends received 45% of the shared input by participants. One respondent replied that learning comes from the client's pediatrician (9.2%), and 18% (2 out of 11) alleged that other therapists were a great source of information.

Table 4.

Neurofeedback Awareness

Themes	Participants	Percentage
Research		
Articles	5	45%
Conferences	2	18%
Technology	3	27%
Communication		
Family/Friends	5	45%
Pediatricians	1	9.2%
Therapists	2	18%

The Role of the Parent or Caregiver

Over half the participants agreed that the process (treatment and paperwork) is a critical role of the parent or caregiver when a child receives neurofeedback. Each category received 40% of the total agreed upon response. Another 45% stated that encouragement from the parent or caregiver is needed, while 18% described the role of the caregiver as essential to skill development so the therapy can be successful at home. Nine out of 11 participants suggested that feedback to the clinician from the parent or caregiver, in the form of monitoring or adjusting therapy, from the clinicians' office, was a key role. According to clinicians, monitoring the client accounted for 27% of the parent/caregiver responsibilities. Making adjustments from the therapy environment to the real life environment where the client function was 55% of the total response.

Clinicians agreed that parents or caregivers improve the results seen in neurofeedback therapy by participating in the process in its entirety.

Table 5.

Role of Parents/Caregivers

Themes	Participants	Percentage
Process		
Treatment	4	40%
Paperwork	4	40%
Support		
Encouragement	5	45%
Skill Development	2	18%
Feedback		
Monitoring	3	27%
Adjustments	6	55%

Typical Neurofeedback Session

Clinicians were asked to describe a typical neurofeedback session. The categories identified were: prior to the therapy session, during the session, and concluding the session. Further investigation acknowledged two themes: site prep and evaluation. Site prep consisted of preparing the client for actual participation in a session and evaluation probed the client for any information that needed to be reviewed from the previous neurofeedback session. This segment of the therapy session provides information pertaining to the client's current mood, any issues or side effects from previous sessions, and preparation to apply the cap and sensors in the appropriate areas. During the actual session participants were provided live feedback to enhance the effectiveness of the

session. Providing feedback is key to the neurofeedback process as evidenced by 45% agreement among the survey participants. Another 27% agreed that when live feedback was provided it needed to be implemented in the current session to improve the session outcome. At the end of the therapy session it was recommended by five of the 11 participants that the client's scalp and hair be washed. Taking time to provide debriefing information immediately following the session was indicated by only one clinician. Proper site preparation and marking was one of the most important factors of a therapy session. There is a direct relationship between the location of an electrode and the underlying area of cerebral cortex so accurate lead placement is critical.

Table 6.

Describing a Neurofeedback Session

Themes		Participants	Percentage
Pre-			
	Site Prep	10	91%
	Evaluation	6	55%
During			
	Feedback	5	45%
	Train/coach	3	27%
Post			
	Clean up	5	45%
	Debrief	1	9.2%

Advantages of Neurofeedback

The following themes and categories describe the superior benefits of neurofeedback when compared to medication, cognitive therapy, behavioral therapy, relaxation training, behavior coaching, or family education and therapy. The concept was first divided into cognitive and outward themes, and then each was further investigated to find like categories in each theme. In the cognitive theme two categories were identified: brain based and physiology based. The brain based category provided data concerning stabilizing the brain. Focusing on stabilizing the brain is a crucial and initial stage when deciding which intervention will be most beneficial. Physiological based was the next theme, which deals with changing the underlying causes of ADHD symptoms or for symptoms related to another disorder. Seven of 11 participants agreed that neurofeedback therapy provided clients with resources to be successful based on the cognitive benefits. While 11 of 11 agreed that outward factors were beneficial to their client's success. The outward theme was condensed into three categories: improved symptoms, overall client perception, and non-use of medication. The external data revealed that long-term change was important to 45% of the clinicians. Out of the clinicians that participated in the study 73% stated that the clients' ability to experience immediate improvement in the symptoms, with no side effects, was the reason why neurofeedback was so successful. Only 27% replied that not having to take medication was the only reason this intervention was better than other alternatives. Clinicians continue to validate increasing evidence of the substantial impact of external factors on

neurofeedback therapy success. Consensus was strong among the participants that neurofeedback therapy is a preferable and effective treatment option for many clients.

Table 7.

Advantages of Neurofeedback

Themes	Participants	Percentage
Cognitive		
Brain	5	45%
Physiology	2	18%
Outward		
Symptoms	5	45%
Clients	8	73%
Medication	3	27%

The next research question asked clinicians to identify the main obstacles to efficiently providing neurofeedback to clients. Common themes were scheduling conflicts, lack of funding, and lack of information related to neurofeedback. The categories identified in the scheduling conflicts theme were: time, consistency, and no shows. Time was identified as the most conceptual obstacle by 40% of the clinicians. No shows accounted for 18% of the scheduling theme and consistency-attending appointments was 9.2% substantial financial obstacles were identified in this study and were also a factor impacting participation in many previous studies. The financial theme consisted of: money, cost, funding, and lack of insurance providers. There was not a consensus on the weight of the impact of money, cost, funding, or insurance, but eight of 11 clinicians

made a reference to finances being an obstacle to participating in neurofeedback therapy. Information is the last theme with categories consisting of awareness, experience, and commitment. Awareness and experience was agreed on by the same number of clinicians (three of 11) demonstrating a 27% commonality. The last obstacle that is significant to providing neurofeedback is commitment. Almost 50% of clinicians agreed that commitment to the neurofeedback process is similar to any other goal or desire of a person. A strong commitment to therapy is critical to success.

Table 8.

Neurofeedback Obstacles

	Themes	Participants	Percentage
Schedule			
	Time	4	40%
	Consistency	1	9.2%
	No Shows	2	18%
Financial			
	Money	3	27%
	Cost	2	18%
	Funding	1	10%
	Insurance	2	18%
Information			
	Awareness	3	27%
	Experience	3	27%
	Commitment	4	40%

Concluding Neurofeedback Prior to Therapy Completion

The last research question analyzed why individuals stop neurofeedback before the suggested amount of sessions are completed. There were two overall themes

identified for this topic and they were broken down into five smaller categories. Financial and outcomes were the themes for discontinuing neurofeedback. More specifically, cost, negative results, positive results, length of time, and other. Of the 11 clinicians, six responded that most clients discontinued therapy untimely because of lack of financial means to cover the cost of the therapy. Within the theme of outcomes are four other categories of possibilities: negative results, positive results, length of time, and other options. Negative results were perceived when clients showed signs of relapse, side effects, or a slow response to therapy. The data suggests that 40% of clinicians felt that their clients stopped neurofeedback too soon because of those specific negative results. Positive results accounted for 27% of the discontinuation of therapy. Clinician number five, 10, and 11 stated that clients stop therapy because they are seeing positive results. Only two of 11 clinicians suggested that uncertified clinicians might lead to drop out. The data analyzed in this study can have a significant impact on the lives of those diagnosed with ADHD or the parents/caregivers that are searching for an alternative intervention to medication.

Table 9.

Concluding Neurofeedback Prior to Therapy Completion

Themes		Participants	Percentage
Financial			
	Cost	6	55%
Outcomes			
	Negative Results	4	40%
	Positive Results	3	27%
	Length of Time	3	27%
	Other	2	18%

Chapter V

Discussion

Attention Deficit Hyperactivity Disorder is a prevalent disorder affecting the individual, their families, and their environments (e.g. school system) (Danielson et al., 2018). This study examined the perceived effectiveness of neurofeedback therapy from the perspective of clinicians who provide therapy. The purpose of this study was to analyze the current state of neurofeedback therapy and provide information about how to successfully educate other individuals regarding the use of neurofeedback as an alternative treatment to medication. All clinicians in the study indicated that they provided neurofeedback therapy for those diagnosed with ADHD. There were two questions examined in this research: What are clinicians' perceptions about neurofeedback as an effective intervention for children diagnosed with ADHD, and how can information about neurofeedback be more efficiently provided to parents and educators?

Research Question #1

The current study collected data from 13 surveys; 11 of those participants completed all 26 questions supplying sufficient data for analysis. Research provided data supporting that clinicians believed neurofeedback to be an effective and beneficial intervention option. From this research question two themes developed, benefits that

focused on the training of the brain cognitively and benefits that can be understood through an outward behavior change in the client.

Cognitive Benefits

Approximately half of the clinicians agreed that training the brain was key to cognitive success in regards to the root cause of ADHD symptoms. This cognitive training allowed the client to generate long lasting benefits that help clinicians and clients make headway in the treatment of ADHD behaviors. Neurofeedback according to one clinician trains neural pathways that translated to positive lasting effects. Another clinician described the cognitive process as changing the underlying physiology of the disorder. Cognitive therapy can identify issues and potential strategies, but it does not solve all the attention problems after an ADHD diagnosis. This study's data was supported by Lansbergen et al. (2011), who focused neurofeedback therapy on teaching the client to be aware of their mind set. Lansbergen et al. (2011) stated that allowing knowledge to motivate the clients' brain waves in certain environments, could improve outward behaviors. By providing neurofeedback therapy, clinicians can observe what was happening cognitively and better target the root of the symptoms being displayed. Cognitively teaching clients techniques to succeed in an academic setting provided them with the necessary tools to grow in environments that require more attention and focus. Allowing clients to feel as though they played an active role in their success in the classroom increased buy-in. Providing the cognitive skills to increase academic success will lead to other benefits that can be visualized in the academic setting. Cognitive

benefits are important for clients of neurofeedback, including outward benefits observed through academic performance and self-regulated behaviors.

Outward Benefits

Approximately 73% of clinicians indicated that neurofeedback impacted behaviors that are related to school, including academic performance and self-controlled behaviors. The current study supported findings from a study by Bakhshayesh et al. (2011) that neurofeedback was effective in the reduction of ADHD symptoms and behaviors observed by parents and educators. Clinicians also conveyed that clients could benefit externally from neurofeedback in three categories: non-invasive, positive results, and long-lasting benefits. An invasive intervention is defined as an intervention that may be harmful to the client because it can introduce foreign matter into the body. Clinicians supported the conclusion that neurofeedback, a non-invasive form of treatment, allowed the student to perform successfully without having to take medication. Another benefit is that neurofeedback provided positive results. Through clinicians' own acknowledgement, 45% stated that outward progress was observed in clients. One clinician stated that positive changes could be observed by the clinician and the client. The client reported feeling better, appeared calmer, and stated that neurofeedback allowed them to respond in a different manner to the same stressors experienced preceding neurofeedback therapy. Long lasting results are very important when it comes to an effective ADHD treatment option. "We move clients further, faster, and with longer lasting effects than medication and talk therapy," was an opinion offered from a

clinician that participated in the survey. Human psychological needs include autonomy, relatedness, and competence and also impact many students diagnosed with ADHD. These psychological needs were confirmed in a study by Rogers and Tannock (2013) who indicated that neurofeedback therapy appeared to improve a child's behavior in the academic setting by encouraging the client to set goals for themselves, advocate, and measure their progress. When this occurs there was a greater chance of continuing improvements.

The current survey data supported research findings by Hart et al. (2018) that parents are searching for an alternative treatment option for ADHD. Many parents do not want their child to rely on medication as an intervention during their academic years. ADHD medication can have many side effects on a child such as decreased appetite, sleeping problems, headaches, or moodiness. More concerning is that without careful observation and collaboration among teachers and parents, some children can took on zombie-like personalities. The current study and a study by Vitiello (2008) agreed that alternative tools were not routinely made available to students with ADHD once medication had stopped. Three clinicians from the survey agreed that neurofeedback therapy is beneficial because medications do not have to be used in conjunction with neurofeedback. The main drawback by clinicians in the current survey was the use of medication therapy as a sole intervention. Although medication can be a successful treatment option for ADHD, it does not provide self-taught skills for the client to implement when the medication is no longer effective.

Clinician Bias

Based on personal knowledge gained from educational colleagues, it was discovered that neurofeedback is not a well-known treatment alternative for ADHD symptoms. Research by Snider et al. (2003) provided support that educators do not have the necessary information in relation to ADHD symptoms and the use of alternative interventions to implement in the classroom. The current study focused on the perceptions that clinicians have regarding neurofeedback treatment. The clinicians that completed the survey, even those that omitted some questions all provided neurofeedback therapy and believed it was a beneficial intervention. Because of the results from the survey, participants were more likely to see neurofeedback as a more beneficial intervention option than other interventions used by ADHD clients. The positive results of neurofeedback therapy could be elevated, so concerns with clinician bias are a possibility. Clinicians that do not endorse neurofeedback as an alternative intervention could possibly have different opinions and suggestions on how to alleviate ADHD symptoms.

Research Question #2

The next research question focused on distributing the information concerning neurofeedback to parents and educators. Based on surveys, clinicians agreed the most efficient method to distribute information about neurofeedback was through personal research or referrals from previous clients and families. Clinicians felt (10 of 11) that parents or educators should conduct their own investigation into neurofeedback therapy

to better understand the process and benefits. In order for clients to research neurofeedback, a list of appropriate interventions including neurofeedback, needed to be provided to the client. The most likely sources of referral for neurofeedback therapy was communication with friends and family, or doctors and therapists. Increased referrals may lead to more insight into this alternative treatment and a better understanding of the process.

Although neurofeedback is a new innovative treatment, research conducted by Arnold et al. (2012) showed that parent ratings concerning neurofeedback improved. Parents witnessed a positive change in their child's behavior not only at home, but in the school setting as well. There was a large correlation between positive behavior changes and a willingness to recommend neurofeedback therapy. Studies supported that neurofeedback played a positive impact on the lives of not only those diagnosed with ADHD, but also parents and educators. This positive impact increased support for and distributed information regarding neurofeedback therapy. Discovering additional dispersal options for therapy information was equally as important as gathering more information concerning neurofeedback. Parents and educators have become more knowledgeable about available interventions through consultation with the child's primary care physician and the Internet. Pediatricians can be the first to suggest that there may be a developmental concern with a child and a developed list of possible treatment options. By utilizing Evidence-Based Medicine (EBM) doctors can provide interested parties with various treatment options for ADHD. One extremely popular

option available for a child diagnosed with ADHD is Cognitive Behavioral Therapy (CBT). Much like neurofeedback, CBT taught the client to identify their thought patterns and implement coping strategies to focus on healthier thinking. It had recently gained popularity because of strong physician support and feedback from positively affected clients (Fullen et al., 2020). When physicians were well versed in various treatment options, parents obtained more information allowing them to make a better decision regarding the treatment option that would best support their child's needs. Through physician support the number of positively affected clients by neurofeedback therapy was also increased in the dissemination of information, which theoretically increased by correlation.

Other Relevant Information

It was the clinicians' perception, that neurofeedback allowed for a specialized intervention plan provided for the individual that supported the client's needs and form of ADHD. A distracted state and lack of attention was seen in brain waves with higher theta levels (Roh et al., 2015). In the opinion of Roh et al. (2015), when the clinician knew the manifestation of their client's ADHD symptoms an appropriate intervention could begin much sooner. Higher theta or beta levels in the frontal areas displayed in scans, provided clinicians information on how to provide the proper intervention. Clinicians' point of views from the current study indicated that neurofeedback was a viable intervention option that was important for educators and parents to be aware of.

Utilizing client background information allowed clinicians to prepare the client for an upcoming session. Preparing the client for what was experienced in a typical neurofeedback session allowed clients to take full advantage of this intervention through decreased anxiety. Therefore allowed them to implement what they have learned in therapy more efficiently (Hasslinger et al., 2020). Clinicians from the survey agreed that when allowed time to provide immediate feedback to their client, improvements in ADHD symptoms can be visualized much sooner. Prepared clients for neurofeedback therapy was agreed upon as significant by 10 of the 11 clinicians in the survey, which accounted for 91%. Each question addressed in the survey provided one more piece of the puzzle, which allowed for a clear picture of the importance of neurofeedback therapy. Clinicians' perceptions of neurofeedback suggested that this non-invasive form of therapy was preferred when compared to more invasive options. Medication was one of the most invasive treatment options available to those diagnosed with ADHD. Medication enters the body and does not always have a positive effect on the child. Hasslinger et al. (2020) addressed this alternative treatment in a study reported that side effects ranged from anxiety, headaches, nausea, and insomnia. Some clients also showed no signs of improvement from the medication. Pharmacological treatment options have improved ADHD symptoms, however they are not long lasting and only provided aid when they were being taken as prescribed. Pervasive lack of adherence to prescribed regimens contribute largely to the ineffectiveness of medications.

An important drawback of neurofeedback therapy is the cost of therapy sessions and the lack of coverage by insurance companies. One clinician stated that since insurance companies rarely pay for therapy, the cost came out of the client's pocket and many families cannot afford that financial burden. In the clinicians perception, medication is a less expensive treatment than neurofeedback, however medication does not ensure the long lasting effects of neurofeedback. A course of treatment for neurofeedback was typically around 25-30 sessions and can cost anywhere from $3,500-$5,000 according to one clinician who participated in the study. Medication was approximately around $3,500, for a 72-month period depending on which type of medication was prescribed. Unfortunately insurance companies provide parents with limited options when it comes to treating their child's ADHD symptoms. However, when trying to decide if neurofeedback or another intervention was preferable to treat ADHD symptoms, it should be based on which option was best for their child and the family. While neurofeedback can be an expensive intervention, the long lasting effects are evidenced for many years. According to clinician surveys the problem is not associated with efficacy or efficiency, but the cost relative to the same timeframe as other interventions. One clinician stated that the cost of neurofeedback therapy is often examined over a 72-month timeframe when compared to other modalities. When inspected over that length of time, medication is a more affordable option, but if the cost was disseminated over the child's entire life it was much less of a financial burden and positively impacted the child. Medication may be less burdensome financially, but when

medication stops being prescribed, or becomes ineffective, the child will begin to display inappropriate behaviors again (Stroh et al., 2008). Parents and educators should be provided with substantial information on alternative intervention options. This research was important because getting information on neurofeedback out to concerned individuals was imperative to a child's success or failure in the school and home environment.

Limitations and Future Research

The first limitation of this study was the limited number of participants that completed the survey. The ability to analyze more participants' answers would have lead to greater delineation of patterns in the themes created from open-ended questions. An increase in participants would also allow for wider demographics in participants, providing a better understanding of the background behind the clinicians' point of view. Clinicians that treat clients in urban areas of Texas may have different strategies or ideas to efficiently provide information to parents than those that provided services in a more rural area of Texas. Clinicians in rural Texas were more difficult to locate because of two reasons. The first one was that most clinicians do not identify as practicing in the smaller cities because many people do not know where smaller cities are located. So when a clinician identified as being from the Dallas area, that can be a wide range of smaller cities, but the client can get a basic idea of the geographical region. The other reason was that in the larger areas there are more clients that can receive therapy

compared to smaller towns or cities. Increased participation would have contributed to more reliable information.

When this study was designed there was little information pertaining to the perceptions clinicians have toward neurofeedback, therefore this study was created to provide parents and educators with information concerning neurofeedback. The reliability and validity that researchers hope to see in a research study was not achievable because the study was constructed without a template and without the benefit of prior research on this topic. After collection of these clinicians' surveys, a future study could then identify where more clarification was needed or if a question should be removed from the survey. The availability of prior research may have allowed for an interview-design survey. Interviewing clinicians could have provided more information, but in this study an anonymous survey was used, so follow-up questions were not possible in order to gain further detail or clarification. To improve answer consistency, interviews could be conducted with clinicians, so that questions could be modified to allow for a more accurate answer or better insight to how a question needed to be worded. Interviews may have decreased the time requirement to complete the survey. There were 26 questions in the survey, which might have added to the lack of participation from clinicians. Some questions asked for a detailed answer that may have required too much time from the clinician. By restructuring the survey process, more thorough information may have been gathered to be analyzed by researchers.

An additional limitation was that no parents or educators received the survey concerning their perceptions regarding neurofeedback. This study focused on the clinicians that provide therapy, but another beneficial piece of information would come from parents/caregivers and educators. Future research should focus on the perceptions of parents and educators to gain a better understanding of their thoughts on neurofeedback and if there was a need for education in the community. Providing additional perceptions from parents and educators as opposed to only clinicians would allow for a more conclusive research study.

The last limitation was the study design itself. This study was descriptive in nature, meaning that no inferences or interpretations concerning the study were provided. The intention of this study was to discover the perception that clinicians have toward neurofeedback as a reliable alternative to ADHD medication. Neurofeedback was studied to provide parents with information regarding this intervention. A large amount of information was gathered to contribute to its findings however, it did not uncover the "why" clinicians have this perception or "why" more information was not provided to interested parties. No variables were manipulated or controlled to provide information; the study was classified as a descriptive design. The research in this study concentrated on providing information and analyzing those findings from the survey. Future research may be designed to uncover why clinicians feel a particular way or what can be done to provide interested parties with the information needed to make an informed decision.

Implications and Conclusions

The current study found that clinicians do consider neurofeedback an effective therapy for their clients with ADHD. This was especially true when qualified clinicians were provided therapy instead of someone that was not properly trained. However, clinicians believed that more information needed to be shared with parents/caregivers and educators as a community. This will provide concerned individuals with a better explanation of neurofeedback and the benefits this alternative intervention offered. One participant encouraged the formation of a family support group for those diagnosed with ADHD. The support group would help parents realize that they are not alone in this challenge, and provide guidance to other families as to what has worked or not worked for their child. This study was beneficial to understanding neurofeedback and how it may help those diagnosed with ADHD or other disorders.

Overall, the results of this study revealed that not enough information concerning neurofeedback therapy was provided to interested parties or those looking for an alternative option. Discovering that neurofeedback therapy was a viable treatment option can provide students with an alternative to medication. The effects of neurofeedback can have long-term results that help children develop into productive citizens, with confidence to be successful in life. The data supported the question that neurofeedback is an effective intervention for children diagnosed with ADHD. The second question asked, "How can information about neurofeedback more efficiently be provided to parents and educators"? Reviewing current data supports the conclusion that past successes will lead

to client referrals. When a client successfully completed neurofeedback therapy their knowledge and expertise were critical to provide others with relevant information. The study revealed that information should come from others that have experienced neurofeedback or information gained by researching alternative treatments. Key information can also be obtained from marketing so that others know there is an alternative to medication. The main goals of marketing and research in regards to neurofeedback should contain three advantages. The first was to base treatment recommendations on evidence-based research so that well designed neurofeedback therapy can be provided to ensure client satisfaction. This should be the top priority if future research was to be done regarding this topic. Another advantage of marketing and increased awareness would be to increase the demand for therapy, causing insurance providers to recognize the benefits of the treatment and provide coverage for the costs. The last advantage was that with increased participation in neurofeedback therapy there would be an increased number of clients suffering from ADHD that function successfully in a variety of environments.

In conclusion, when the data was examined, many participants felt as though approved qualifications by the BCIA, quicker results, long-lasting results, and minimal side effects were the main benefits of neurofeedback. They also agreed that the main obstacle to providing neurofeedback therapy was the cost and lack of coverage by insurance companies. Research agrees that ADHD medication was an affordable option when compared to neurofeedback, yet in research results, neurofeedback showed to be

more effective in the long term when compared to medications. Negative side effects associated with medication are of great concern to parents and children. Collaboration by parents, caregivers, educators, and even students are key to the student's achievements.

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