



Research Article

Changes in Listening After Children with ASD Complete an Experimental Listening Program: Pilot Study

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Abstract

Children with Autism Spectrum Disorders (ASD) often are found having sound sensitivities tolerating loud sounds, background noises, and unexpected sounds they may hear. One treatment often used is a listening therapy. Research and clinical observations indicate that listening therapies often take three months or more before improvements are noted. An experimental listening program called Acoustical Neuromodulation (ANM) was used to see whether ANM might reveal significant improvements in listening and noise tolerance for children with ASD in a shorter period of time. Sixteen children participated in this preliminary study. They completed the ANM listening program over two-weeks. The people working with these children completed a pre-therapy and a post-therapy listening inventory. Analyses of the data indicated significant improvements based on questions from The Listening Program Listening Checklist. These changes revealed less distraction and sensitivity to background noises as well as better ability to interpret what is spoken to the children, having a more appropriate “sense” of personal space, less fidgeting, and a better sense of rhythm and timing. Thus, results of the present pilot study indicate significant improvements in sound tolerance, listening, comprehending what is spoken, and even in some personal and social factors after only two weeks of the ANM listening therapy.

Keywords: Listening Therapy; Children with Autism; Acoustical Neuromodulation (ANM)

Introduction

Children diagnosed with Autism Spectrum Disorder (ASD) are often noticed having problems dealing appropriately and successfully when listening, especially in noisy environments and when there are loud sounds present. They also are reported having problems tolerating background noises and sounds they do not like. These children are often identified having auditory hypersensitivity

also known as hyperacusis [1-4]. One treatment often used is a listening therapy. Research has demonstrated improvements in listening and sound tolerance after children complete a listening therapy, including children with Autism Spectrum Disorder (ASD) and other disorders [1,2,5-10]. Typically, listening therapies take 3 months or more to complete. This time length has been identified in some of the studies cited above. For example, Butler, Schueler, and Lucker [5] discuss pre and post therapy for 456 subjects who completed The Listening Program in approximately 10 months (about 40 weeks) revealing very significant improvements in their

auditory processing and listening abilities. Lucker and Doman [2] discuss that The Listening Program typically takes 20 weeks (5 months) to 40 weeks (10 months) to be completed. Nwora and Gee [9] identify that the subject in their study took 20 weeks (5 months) to complete The Listening Program before significant improvements were noted. Gee, Thompson, St. John [6] identify that their subjects took 10 weeks (2-½ months) to complete the therapy. Also, Gee, Thompson, Pierce, Pierce, Toupin, and Holst identify that their subjects needed 28 weeks (about 7 months) of therapy [7]. Jeyes and Newton state that their participants needed 10 weeks (about 2-½ months of therapy [8]). Thus, these published studies indicate that a listening therapy can require listeners to complete the therapy between 2-½ months (10 weeks) to as long as 10 months to show significant improvements in their listening and auditory processing abilities.

A new type of listening therapy has been developed to relieve many symptoms associated with ASD, including listening problems. It requires much shorter time period to see improvements compared with what is discussed above. This patented therapy (BioSensor, Inc. U.S. Patent US 10,772,529,B2) only takes two weeks to complete. This therapy delivers unique and specific types of sounds based on the well-characterized brain wave frequencies (alpha, beta, gamma, etc.). This patented therapy is known as Acoustical Neuromodulation (ANM). The application of this therapy was originally developed for use with people having tinnitus.

Reviewing what is published regarding the application of this therapy for tinnitus (known as Acoustic Coordinated Reset Neuromodulation (ACRN)), it was used solely with people having tinnitus [11]. This research looking at ACRN as a treatment (therapy) for tinnitus indicates that during a session, an acoustic signal embedded in music to stimulate neural circuits in the brain is provided, and this listening helps patients desensitize to the ringing in the ears (tinnitus) improving listening in these people.

Looking further into how ACRN is scientifically noted to make these changes in reducing negative auditory effects in tinnitus, and thus, improving listening, the following was found. In an article published in the *Journal of Therapeutic Ultrasound* [12], the authors describe the scientific and mathematical factors presented using biophysical models to explain how ACRN can make changes in the auditory system and, thus, reduce the annoying effects of things like tinnitus. Further research identified a number of studies discussing the use of ACRN in reducing problems with tinnitus in people who have undergone this therapy [11,13,14].

A group of specialists using the ACRN factors then developed a listening therapy program which they felt might be beneficial for use with children having auditory hypersensitivities, especially children diagnosed with ASD. This led to an American based company that specializes in listening therapy (i.e., Advanced Brain

Technologies) to pilot research incorporating ANM as a listening therapy for such children. What is special about this therapy is that it involves the person completing the program in only two weeks doing the listening. Since the discussions above indicate that the therapy needed to be completed typically takes much more than a few weeks, one hope is to improve the listening tolerance and abilities in children, as soon as possible. This new ANM program appears to provide a quicker, positive improvement in listening and sound tolerance for children diagnosed with auditory sound tolerance problems, especially those diagnosed with ASD.

In a series of unpublished research studies provided to the authors of this paper, research was completed by Dale Foster, Ph.D. of Memphis Integral Neurofeedback Institute, LLC, Gabriel Newman, Ph.D. of The Neuroscience Team, Wesley Center, Ph.D., from Burleson, TX, Anthony Silver from Westport, CT, and Richard Abbey from Ph.D., from Palo Alto, California. These researchers investigated changes based on input pre- and post- treatment from the Autism Treatment Evaluation Checklist (ATEC) and the iHART questionnaire, and changes in neurological functioning based on EEG recordings. Their findings revealed “reduced symptomatology” and “significant and reliable changes in brain networks in ASD children” (cited from author’s input from their unpublished, written research study titled “Acoustical Neuromodulation (ANM) Treatment for Autism”).

In their unpublished written work, these neuro feedback specialists identified above describe that ANM was administered to 30 subjects identified with Autism Spectrum Disorder (ASD). Six sessions were completed for each subject after parent or legal guardian’s signed permission and release forms allowing their children to participate in the study. However, each of the subjects did not complete the same exact sequence in their ANM treatment. The focus was merely to see whether ANM made changes for these subjects and, then, to look more carefully at whether the changes differed based on the specific ANM protocol followed. As for their preliminary results, 77 ATEC questionnaires were completed pre- and post- treatment. Results indicated reduced symptomatology in ASD behaviors for the majority of subjects for all four categories (Language, Cognition, Behavior, and Sociability). Correlation was computed between results from the ATEC and the iHART with a significant relationship (correlation) found ($p < 0.0001$). Additionally, these researchers found a very significant change ($p < 0.0001$) on t-test calculations for differences in the EEG functioning of their subjects after completing the ANM therapy. Thus, overall, both in behavioral observations based on the two checklists/questionnaires, and in neurophysiological functioning (EEGs), after ANM therapy, significant improvements were found.

To follow-up on this unpublished research discussed above, an American-based company that specializes in listening therapy

(i.e., Advanced Brain Technologies) decided to pilot a study with children diagnosed with ASD who complete the ANM listening program for a two-weeks by having their parents, monitor the children doing the listening therapy at home and having the parents complete the Listening Checklist developed by Advanced Brain Technologies (see appendix) pre- and post- therapy. Thus, a standard listening questionnaire was completed by these people just as the questionnaires were completed in the unpublished research study discussed above. The questionnaires completed by the parents were forwarded to one of the authors of this paper (Dr. Lucker) who completed a statistical analysis of the changes in observations made by those completing the questionnaires comparing pre-ANM with the post-ANM input. (Further discussion of the analysis is provided in the methods section of this report.) It was hoped that some significant changes (for better, and thus, improvements) would be seen in these children with ASD after completing ANM listening.

Methods

Participants

The acknowledged person who helped obtain participants for this study, Micki Allred, Speech-Language Pathologist, works at a private school for children with Autism Spectrum Disorder (ASD). Ms. Allred obtained permission from the school's principal to contact the parents of all children in the school providing the parents with a brochure and consent form which provided information about the study, what the parents would have to do to monitor their children who participate in this research study. All the parents had to do was ensure the headphones were worn properly by their children and they were listening to the ANM therapy which was provided to the parents for accessible use daily for their child to do each phase of the ANM listening therapy. Parents who approved that their child participate in this research study were then provided with The Listening Checklist (see appendix) and instructions to complete the checklist before their child started the therapy and then three weeks after their child completed the two months of ANM listening.

Parents of sixteen children, all having a diagnosis of ASD, approved their children to participate in this pilot study. These children completed the ANM listening program over two-weeks doing the listening therapy at home while monitored by their parents. The parents working with these children completed the questionnaires both pre-treatment and post-treatment. The completed questionnaires were then given to Ms. Allred who emailed them to Dr. Lucker, primary, corresponding author who provided the analysis of the findings, discussed later.

The children included 12 boys and 4 girls. They ranged in age from 5 years to 13 years with a mean of 9.7 years, and a standard

deviation of 3.3 years. They completed the listening therapy under the supervision of their parent. Because of the small number of subjects involved, this is considered an initial, pilot study. However, as the reader will see, the findings are very positive recommending further investigation in the use of the ANM program with a greater number of participants.

Material

Two primary "materials" involved in this research were the following. One was the ANM program and all of the equipment used with that program. This material was provided to each of the parents approving their child to participate in this research study. Also, the parents monitored and identified that their children participated in the ANM listening therapy voluntarily which is considered assent by each child to participate in this research study.

The other was The Listening Program Listening Checklist (see appendix). It should be noted that the same questionnaire was used for both pre- and post- treatment.

The Listening Program Listening Checklist asked the parent monitoring the child's involvement with the ANM therapy to identify factors related to listening including general listening (identified as Receptive Listening in the Checklist), which includes understanding what people are saying to the child (Language Comprehension), Expressive language (identified as Expressive Listening, which involves the person's abilities to express themselves, as well as some other areas including Motor Skills, Behavior and Social Adjustment, and "Level of Energy" (which is related to some behaviors seen with the child), Developmental History, Environmental History, and Foreign Languages (which all involve background information about the child.

As for completing the ANM, the parents of children diagnosed with ASD were contacted and provided with background information regarding the therapy by Ms. Allred. The background information included an overview of the actual therapy task in which the children were to listen to a streamed audio recording for a set period of time (30-minutes) every day for two-weeks. The parents monitoring the children completing the ANM therapy were instructed as to the types of headphones to be used which were provided to them along with the link to the ANM recorded material. The person involved in contacting the parents (Ms. Allred) monitored that the parents completed the initial and final questionnaires which were then emailed to Dr. Lucker with the children's identifying information removed. The parents' input on the questionnaires was then converted from the responses as noted on forms to numeric values so that non-parametric statistical analyses were able to be performed comparing results from the initial input to the final input to determine whether significant changes (preferably improvements) were found.

The initial completion of The Listening Program Listening Checklist was provided when the parents of the children agreed to allow their children to participate in the study and signed an agreement form regarding the participant’s involvement in the research. The second, post treatment completion of the checklist occurred six weeks after the children started the ANM program which would be four weeks after they completed the listening therapy.

The program itself has the child listen to a recording of tonal variations of specific frequencies which are believed to make modifications in the brain’s responses to auditory stimuli including connections via the non-classical auditory pathways connecting the auditory and sensory systems to the emotional centers of cortex in the limbic system [3].

Procedures

A flyer was developed to notify parents of the program and to get their approval for their child’s involvement in the program. The acknowledged Speech-Language Pathologist, Micki Allred agreed to get parents to allow their children to complete the ANM listening program as well as complete the pre- and post- treatment questionnaires.

Because this was a private research study conducted by the authors and the acknowledged participant, and since there was no institution involved in this research, including the school, since all therapy and completion of the questionnaires were completed at home, there was no need for an Institutional Review Board (IRB) to review or approve the research. The school’s involvement was only to allow Ms. Allred to send the research study information brochure and The Listening Checklist to all of the parents having children with ASD who attend the school. However, the primary investigator, Dr. Lucker, is an internationally known specialist and researcher who has provided numerous research studies so that his development of the procedures and evaluation of the findings from the completed Listening Checklists followed standard research methods and analysis, described next.

Analyses of The Listening Checklist

Once the questionnaires were completed, they were forwarded to the Dr. Lucker who did the following.

Looking at the appendix with the sample, blank questionnaire, the reader will note that it is divided into 8 parts. The first two parts (Receptive Listening and Language as well as Expressive Listening and Language) use a rating scale in which the four choices were: Always, Sometimes, Occasionally, and Never. The person completing the questionnaire rated each question relative to their observations of the child for whom the rating was being completed. Since there were four ratings, for statistical analysis, numbers 1 through 4 were used to identify the rating provided.

Thus, if a person rated the child as “Always”, the child was given a rating of 4, while a rating of 1 was provided when “Never” was checked off.

For the sections of the checklist involved with Motor Skills, Behavioral and Social Adjustment, Level of Energy, Developmental History, and Environmental History, the responses were only Yes or No. For these responses, Yes was analyzed as 1 and No was analyzed as 0. The last part of the questionnaire asked about Foreign Language Exposure which was handled descriptively, just identifying the different languages to which the children were exposed.

Because these numbers were not “real” values, nonparametric statistical analyses were used to compare the ratings for each question pre-treatment versus post-treatment. These statistical analyses included the Mann-Whitney U Test for the Receptive and Expressive Listening scales while Chi-Square analysis was used for the Yes/No ratings.

Results

Table 1 presents the results for the Receptive Listening and Language along with the Expressive Listening and Language measures used.

Measure	Question	U-value	p-value
Receptive Listening and Language	1	95.1	>0.05
	2	89	>0.05
	3	70.5	<0.05*
	4	56	<0.05*
	5	73	<0.05*
	6	102	>0.05
	7	90.5	>0.05
	8	94	>0.05
	9	117	>0.05
	10	102.5	>0.05
	11	100	>0.05
	12	105	>0.05
	13	113.5	>0.05
	14	107.5	>0.05
	15	109.5	>0.05
	16	111	>0.05
	17	97.5	>0.05
	18	89	>0.05

*p<0.05 is significant; p>0.05 is not significant

Table 1: Results from the pre-therapy and post-therapy completed Listening Checklists for the Receptive Language and Listening measure based on non-parametric Mann-Whitney U Test Findings.

As noted from this table, only three measures from Receptive Listening and Language (Questions #3, #4, and #5) were identified having significant improvements ($p < 0.05$). All other questions were not found to reveal a significant difference between pre- and post- treatment ratings in this area. These three significant questions related to the following.

Question #3 asked the rater to identify the value for “Easily distractible, especially by noise” indicating a reduction in background noise sensitivity and improved ability to filter out background noises and focus on the primary verbal input for the child. Question #4 asked the rater to identify the value for “Oversensitivity to certain sounds” which is often referred to as auditory hypersensitivity or hyperacusis, and research involving sound sensitivity in children with ASD [1-3] has revealed this to be a primary problem with auditory processing in these children. Question #5, “Misinterprets questions and requests” involves the auditory processing of getting what people ask of the child or telling the child what to do. Thus, significant improvements were found only after two weeks for these three auditory processing factors after ANM treatment was completed identifying that the ANM treatment can improve auditory processing and thus, listening skills in children with ASD.

In contrast to these significant findings, results for all other questions regarding Receptive Listening and Language were not significant. These questions related to the following factors: Difficulty Staying Focused and Short Attention Span which would be related to attention and executive functioning problems, and not to specific listening or Auditory Processing Disorders (APD); Difficulties in Sound Discrimination, Confusing Similar Sounds in Words which is related to auditory phonological processing which is an area of auditory processing that is not trained in sound based listening therapy like ANM; Needs Repetition and Clarification More than Usual, Able to Follow only One or Two Instructions in a Sequence which could all be due to problems with attention and executive functioning more so that to APD issues; Poor Short-Term Memory, Poor Long Term Memory, Must Read Material Several Times to Absorb Content which could also be related more to cognitive processing and executive functioning than to APD issues; Tires Easily, Becomes Sleepy When Listening to Speakers or Reading, which could also be related to poor attention and executive functioning as well as overworking his processing system; Difficulty hearing low male voices, Difficulty hearing high female voices which could be more related to hearing in general, but possible also due to listening attention problems; Seems that most people speak too fast which could be related to a special area of auditory processing known as auditory temporal processing which would not be related to listening to sounds such as presented in the ANM therapy. Thus, the findings in this first area do reveal that people observed significant improvements in many areas

of auditory processing, but other areas may also need different treatments along with ANM to help improve the overall auditory information processing abilities of children with ASD.

For the second area of Expressive Listening and Language, no significant differences were found for any of the questions asked. This is not surprising in view of the fact that the ANM program focuses on listening and input (Receptive) factors and not on output, speaking, Expressive language factors.

The next areas all used Yes/No responses which were identified as 1 or 0. The Motor Skills revealed three significant improvements for Questions #2, #5, and #9. No other Yes/No questions revealed significant improvements. Table 2 presents the results for the Motor Skills based on Chi-Square statistical analyses.

Measure	Question	Chi-Square-value	p-value
Motor Skills	1	0.1255	0.72316
	2	4.9303	0.02639*
	3	0	1
	4	0.1296	0.71889
	5	4.9303	0.02639*
	6	0.05333	0.46521
	7	1.166	0.28023
	8	0.1829	0.66893
	9	3.8647	0.049311*
	10	0	1
	11	0.1385	0.70975
	12	2.23272	0.12712

* $p < 0.05$ is significant; $p > 0.05$ is not significant

Table 2: Results from the pre-therapy and post-therapy completed Listening Checklists for Motor Skills Results from the Listening Checklist Based on Chi-Square Analysis.

Question #2 looked at changes for “Inadequate sense of personal space or physical boundaries” which may relate to the children being better able to listen and follow directions related to what spaces and boundaries are appropriate for them to have. Question #5 looked at changes for “Fidgeting” perhaps because improvements in listening may have had these children be more focused and less needing something to do, like fidgeting. Question #9 looked at “Poor sense of rhythm and/or timing of movement” which would involve auditory processing related to what is known as auditory temporal processing (rhythm).

The next area investigated involved Behavioral and Social Adjustments. None of the questions in this area revealed significant differences after completing ANM. This area also likely involves more of self-regulation and executive functioning than specific auditory processing abilities. This was also found for the areas of Developmental History, and Environmental History which would

not involve auditory processing since development factors focus on how the individual has grown and “developed” over time, and the Environment may have been the same, not changed over time, but these factors would have nothing to do with auditory processing and listening skills. Thus, ANM therapy revealed significant improvements in those questions identified above which indicate very important improvements in listening and auditory processing especially after only two-weeks of the listening treatment.

Conclusions

As reported above, three questions on the post-treatment questionnaire looking at receptive language and listening indicated a significant improvement in observations made with these children. These questions were for Question #3 (“Easily distractible, especially by noise”) which indicated a significant reduction in background noise sensitivity and improved ability to filter out background noises and focus on the primary verbal input. Question #4 (“Oversensitivity to certain sounds”) known as auditory hypersensitivity or hyperacusis [1], revealed a significant reduction in sound sensitivity in children with ASD. Question #5 (“Misinterprets questions and requests”) reveals a significant improvement in the auditory processing of verbal input when people tell the child what to do. Thus, significant improvements were found for these three auditory processing factors after ANM treatment which lasted only two-weeks.

These are important findings in view of the research indicating that one of the most commonly identified problems with children diagnosed with ASD is that they have oversensitivity to loud and distracting sounds and noises. This has been identified as a significant concern in many published articles [1,2,4,6].

In addition to these significant improvements noted with auditory sound tolerance and listening, significant improvement was reported in the area of Motor Skills. Question #2 (“Inadequate sense of personal space or physical boundaries”), These motor skills may have improved because the children were better able to listen and follow directions related to what spaces and boundaries were appropriate for them to have. Question #5 (“Fidgeting”) may have improved because improvements in listening may have led these children to be more focused when hearing things with less need to do fidget with things. Question #9 (“Poor sense of rhythm and/or timing of movement”) is likely related to significant improvement in the auditory processing involved in what is known as auditory temporal processing (rhythm) as discussed above. These factors were also noted as problems in children with ASD indicating how a listening therapy may help reduce these problems in previous publications [4-7]. However, this sited research discusses listening therapies that need months of listening treatment before improvements are noted.

Thus, after only two-weeks of listening via the ANM program,

significant improvements were noted for the children with ASD involved in the present study, especially related to their listening and auditory processing abilities, with additional improvements in some areas of behavior which could be related to the improvements in their auditory processing abilities. What is important to note, however, is that many other areas investigated using the questionnaire completed by the parents and teachers in the present study did not reveal significant improvements. This is likely related to the fact that ANM therapy focuses on listening and auditory processing and not on factors discussed above that may influence the children’s behaviors such as self-regulation and executive functioning skills.

What may then be needed is that once a child with ASD completes the ANM therapy, the child may need to do some additional therapies to improve other areas involved with auditory processing, such as auditory distractibility, also known as filtering out unwanted background noises [15], as well as therapies for self-regulation and executive functioning which may then show significant improvements in these areas in less time than what may otherwise be seen if the children did not complete the ANM. Additionally, it would be interesting to see whether the ANM therapy does provide better changes in children with ASD compared with other listening therapies. Further research is needed to look into the changes in listening and auditory processing found in children who undergo ANM followed by other treatments compared with children who merely complete a listening therapy alone or the ANM alone.

we consider previous research and information regarding listening and auditory processing skills in children with ASD, what is important to note is that, first, many published articles discuss that one significant problem found in such children is that they have problems in listening and dealing successfully with sounds and noises, and, second, that they reveal improvements in their listening skills being better able to tolerate the noises and be better in their listening skills in general after completing a listening therapy [1-7,10]. However, noting what the authors of these cited research studies see when children with ASD are involved in a listening program, it typically takes 6 months or longer for them to complete the program and show the changes seen in listening and auditory processing. Thus, considering that the ANM therapy is completed in two weeks, this is a great improvement and benefit in helping these children progress towards levels where they are not having listening and auditory processing problems, as well as when they start working on other treatments to improve other behavioral and communication problems they have [16].

Limitations and Other Recommendations for Future Research

In addition to the recommended future research discussed above, additional research may be helpful. One relates to the small sample of only 16 participants used in the present study. To confirm that ANM listening can make significant improvements

in listening and auditory processing in children with ASD, a larger sample of children should be involved in future research. Also, listening therapies are often used with children who have auditory processing problems who were not diagnosed with ASD. Thus, future research would be appropriate including a good size sample group of children with listening and auditory processing problems not identified having ASD.

Another limitation of the present study is that the questionnaires used for analysis were descriptive questionnaires completed by the parents or those monitoring the children involved in this present study. What would be important for future research is to have a group of children with and without a diagnosis of ASD complete ANM with a comprehensive assessment of their auditory processing abilities before starting and after completing the ANM using formal, standardized objective measures, such as those used in traditional auditory processing evaluations [15]. Changes in auditory processing specific to the different measures employed would provide greater input regarding how ANM can make changes (hopefully, improvements) in these children's auditory processing abilities.

The last limitation identified and discussed here has to do with a time factor. The results of the post-treatment questionnaire were provided only after the children completed four weeks after the two-weeks of ANM therapy. These changes could be initial improvements, but they may not last or they may actually show greater improvements over time. As the auditory system and brain make changes because of the ANM therapy, these changes can significantly improve a person's listening and auditory processing over time, post therapy. Thus, future research should investigate the changes in auditory processing and listening abilities over time such as after six months and one-or-two years post ANM treatment.

As for the present pilot study findings, results discussed above have identified very significant improvements noticed in these children diagnosed with ASD who completed the two-weeks of ANM therapy. That finding alone supports a conclusion that ANM therapy is a useful and appropriate treatment to improve listening and auditory processing in children diagnosed with sound sensitivity and loudness tolerance problems. Future research is needed to support this conclusion, but the present pilot study opens a new treatment plan that may be very helpful improving the auditory processing abilities and reducing sound tolerance problems in children, especially those with ASD.

Declaration

Conflict of Interest

Jay R. Lucker has no conflict of interest regarding his involvement in this research study and document. Alex Doman has no conflict of interest except that he is the Founder and CEO of Advanced Brain Technologies, which is identified in the article.

Ethical Approval

All of the parents of the children who participated in this study, and the educational participants who monitored the children and assisted in their completion of the ANM therapy completed a Consent Form that included a Consent to participate in this study and a Consent to allow the researchers (authors) to publish the research providing no specific information regarding the children who participated in the study except for the age factors for the entire group and gender factors (number of males and females) who participated in this research. Also, the Acknowledged person who assisted in obtaining the children and even monitoring some of the children consented to allow her name to be provided as acknowledged and as written in the article.

The study was not conducted through any institution (such as one of the two universities to which the author Jay R. Lucker is affiliated). Thus, there was no need for an Internal Review Board to review and accept the research as a proposal. Alex Doman (one of the authors) is the CEO of Advanced Brain Technologies so he approved the consent form developed and submitted to the parents and, in any cases, legal guardians of the children involved in the study. Thus, there is no IRB needed to complete this research study. Also, Dr. Lucker is an internationally known expert in the field of auditory processing and has completed many, many research studies and, having been a professor at numerous universities, he is well aware of and knowledgeable of the appropriate methods for provided an Ethical research project including the present research involved in this article.

Research Applicability

This ANM listening therapy used in this research study is applicable only for humans. No animals were used nor are felt to be appropriate for the research conducted in this study.

Ethical Committees & Internal Review Board

Because this was an independent research study, there was no Ethical Committee nor Internal Review Board involved. This research was not completed through any affiliation by any of the authors nor the Acknowledged Speech-Language Pathologist identified with any universities, institutions, or organizations that would require review of a proposal for this research to be obtained. The children were students at the school, but he heads of the school was only involved in agreeing to provide contact between the Acknowledged Speech-Language Pathologist and the parents of all students at the school, and the parents were provided with the flyer regarding the research study and with contact with a person from Advanced Brain Technologies once they agreed to have their children involved in the research. The parents were specifically informed that they would monitor their children doing the ANM listening therapy, and that the Listening Checklists they completed pre- and post- treatment would be provided to one of the authors

who did the statistical analysis of the parents' input to see what changes were made.

Consent for Publication

All parents were informed that the results of their child's performance based on the parents' input on The Listening Checklist would be used to analyze what changes are noted before versus after the children complete the ANM listening therapy. Also, the parents were informed that the overall results for the group of children involved in this listening therapy study would be used for publication, and no identifying information would be provided regarding their children other than gender, age, and the pre- and post- treatment Inventory results for the group as a whole, and not for any specific child. Thus, all children involved in the study are anonymous and are not identified in the article for publication.

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Availability of Data and Materials

The authors are willing to share the data from this research. All of the data for the group as a whole is provided in the Tables presented in the study. Data for each individual subject used in the study is not available since parents provided permission for their children to be involved and that The Listening Checklist data will be used ONLY for the group as a whole which is what is provided in the tables presented.

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It is also stated that there was no funding provided for this research. Alex Doman, CEO of Advanced Brain Technologies provided all the material needed and used in this research through his company.

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