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The effect of sound therapy with Forbrain® on reading skills and auditory discrimination for students with reading difficulties.

Accessible Summary

- It seems that most researches are devoted to the problems of students with dyslexia, and the students with reading problems are ignored.
- According to the available researches most of children and adults with reading and learning difficulties suffer from problems in auditory attention and processing.
- The auditory processing is one of the basic prerequisites of learning. auditory processing include auditory discrimination, auditory memory, sequence, and order
- This research shows that sound therapy with Forbrain can improve auditory discrimination and reading skills in students with reading difficulties .
- Further research is needed to better understand the effects of Forbrain for students with reading difficulties.

Abstract

Background: The lack of success in acquiring reading skills in early school years, can deeply prevent students from achievement in most other educational subjects. Research shows that most of children with reading and learning complications suffer from problems in auditory processing. It may therefore be suitable for those who have reading difficulties be treated with sound therapy. This study aimed to assess the effect of sound therapy with Forbrain on reading skills and auditory discrimination for students with reading difficulties.

Material and Methods: This study was a quasi-experimental design with pre-posttest and control group. The sample group was 20 students who were studying in elementary school (second and third grade). They were selected by available sampling method and assigned randomly to two experimental and control groups. Data were collected by Reading & Dyslexia Test (Karami nori & Moradi 1378) and Wepman auditory discrimination test (WADT 1987). After pre-test the experimental group for 20 sessions was trained by sound therapy with Forbrain while the control group received no intervention. Then, the subjects of two groups were tested by post-test. The statistical models were

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the Analyze of Covariance (ANCOVA).

Results: In the post-test, mean of reading skills ($p= 0.000 < 0.001$), and auditory discrimination ($p=0.000 < 0.001$) in experimental group decreased significantly. This difference also was significant for all subscales of reading skills except Rhyme and Reading non-words ($p=0.07, 0.96$)

Conclusions: The findings show that sound therapy with Forbrain has significant effect on reading skills and auditory discrimination in students with reading difficulties.

Key words , Forbrain, reading skills, auditory discrimination, learning difficulties, students.

Introduction

Reading is a kind of mental-lingual process based on the visual information, reader's awareness, as well as phonological and semantic rules. It is the product of cognitive and linguistic capabilities, prior knowledge, and getting specific reading skills (Allahradi, Modaresi, and Mohammadi 2001). This skill is the most fundamental learning tool for students, since reading, and comprehension are the basic requirements to acquire any type of written information (Sen, 2009). Children with poor reading skills can be classified into dyslexic children, and non-dyslexic ones with lower intellectual ability or other problems. Reading difficulties is defined as reading performance or spelling skills lower than the required level based on child's age, intelligence quotient, and training (Palomo-Alvarez and Puell, 2009). Reading difficulties are important because they can deter educational progression. The lack of success in acquiring reading skills in early school years, can deeply prevent children from achievement in most other educational subjects. Anyway, it seems that most researches are devoted to the problems of students suffering from dyslexia, and children with poor reading skills but without dyslexia are to some extent ignored.

One of the basic prerequisites of learning is the auditory processing (Garcia et al, 2007). Research shows that most of children and adults with reading and learning complications suffer from problems in auditory attention and processing (Farmer & Klein, 1995, Meng, Sai, Wang et

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al, 2005). Auditory processing includes auditory discrimination, auditory memory, sequence, and order (Alpiner, McCarthy & Patricia, 2000). Since poor readers have difficulty discriminating two auditory temporal stimuli (Hari & Kiesil, 1996; Hautus & et al, 2003), and they take more time to discriminate auditory stimuli (Heiervang, & et al, 2002) and are more prone to make mistakes in such cases, it seems that one of the reasons for their failure in acquiring reading skills is their lack of auditory discrimination.

Review of Literature,

Ahissar & et al (2000) showed that poor readers, have problems in auditory processing, as well- especially in cases that require discriminating frequencies. There are a lot of studies that attribute reading problems to fundamental deficiencies in articulation and hearing systems (Dougherty & et al, 1998), consequently sound therapy is one of suggested treatments for such people. The effectivity of this method was firstly introduced by Tomatis, was confirmed in different studies and samples, but based the literature sound therapy is most influential in learning and reading disorders. For example Glimor (1999) and Gerritsen (2009) - in their meta-analysis- approved the effectivity of sound therapy on learning disorders including reading problems. There are different clinical programs and procedures for sound therapy, and the classic one is employing music and creating vibration. Recent developments in technology are employed in designing the relevant tools. One of these new tools is the Forbrain headset which functions via vibrational stimulation to stimulate the bones and convey information through them into nervous system and brain. The dynamic filter utilized in the headset not only improves auditory quality, but also improves the performance of the vestibular system (Escera, 2014). This device is new and consequently there is little research on it. Escera's study showed that Forbrain headset improves focus and reduces reading problems in students. Since there is no unique and accepted method as a definite solution for reading problems, we cannot suffice to the existing treatments. New technologies should be tested, as well.

Research Questions

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Based on the above, the present study aims to answer the following question: is sound therapy with Forbrain able to help students with reading difficulties improve their reading performance and auditory discrimination?

Materials and Methods

This research was a quasi-experimental research with two groups (control and experimental) and pretest-posttest. The statistical population included all 2nd and 3rd grade students with reading difficulties in Tehran (2016-2017 academic year). The sample consisted of 20 students with reading difficulties selected based on research aim from available students who scored lower in Karami, Noori, and Moradi's reading test. Then, they were randomly assigned into two experimental and control groups (each group contained 10 participants). The inclusion criteria of participation in the study include: non-dyslexia based on dyslexia prognosis DSM-5, low raw scores in Karami, Noori, Moradi's reading test, refraining from medicine (Ritalin), age between 7 to 9 years old, and normal IQ scores based on Wechsler IQ test. The criteria for excluding the students from the study: Simultaneous disorders like ADHD, collapsed families (divorced or drug addicted parents, etc), sensory and motor problems were our criteria to exclude subjects. The following instruments were used to collect the data:

Standard Reading and Dyslexia Test: developed by Karami, Nouri, and Moradi (2008) includes several subscales for students from the 1st to the 5th grade. This test was used for 5 years from 2003 to 2007 on 1614 students in five different grades (770 males, and 884 females) in Tehran, Sanandaj, and Tabriz. After data collection, the data were statistically analyzed separately for each school grade in each city and the raw and normal scores were calculated. This test has been widely used in different studies (Behmard, 2011). In the present study the Cronbach's alpha of .79 was obtained for the total test.

Wechsler IQ Test for Children Revised- Fourth Edition: In order to measure students' IQ, Wechsler IQ Test for children, 4th edition was used. This edition was standardized for a sample of 2200 American kids aging from 6 to 16 in 2002. The internal reliability coefficient of .94 for

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the test, .94 for each of four oral comprehension factors, .92 for cognitive reasoning, .92 for active memory, .88 for processing speed, and finally .97 for the test as a whole were estimated. Consequently, we can declare this instrument as reliable and stable. The present study makes use of the edition translated by Abedi, Sadeghi, and Rabie (2011) and normalized in Isfahan. The results reported by them indicated a high degree of validity and reliability for the translated edition.

Wepman Test for Auditory Discrimination: This test was initially designed by Wepman in 1958 and was revised for English speaking kids aging between 4 to 8 in 1973 and 1987. This test includes 40 pair of words in which 30 are different and 10 identical, that is, the same word is repeated twice. The different pairs are all minimal pairs, i.e. two meaningful words only different in one sound. Identical words are scattered throughout the words. The total score for this test is 40, that is, one score for each correct answer (Bakhtiari, 2012). To administer this test, the answering procedure was carefully explained to the children. Each correct answer received one point. The incorrect answers received no point. The total points were considered as the auditory discrimination score of the children.

Before initiating the research, parents and students were thoroughly informed, and their written consent letters showed their willingness to participate in the study. All participants took a pretest. Then, 10 members of the intervention group took 20 sessions of sound therapy with Forbrain, while the control group received no intervention. Each session took 30 minutes (two periods each 15 minutes and 60 minutes break time in between¹). During sound therapy, the students and the therapist were sit face to face, and Forbrain headset was being used.

The previous session exercises were reviewed as well until the student got enough master in that skill. The details of the sessions are reported in table 1. To complement the research and posttest, a week after the end of treatment sessions, both groups took Karami et al's Reading Standard

¹-According to the standard protocol, using Forbrain for more than 15 minutes in children can lead to headache and dizziness .

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Test, as well as, Wepman's Auditory Discrimination Test. The obtained data were statistically analyzed using covariance and SPSS 22 software.

Results and Discussion

The data are presented in two sections: descriptive and inferential. In descriptive section, the mean and standard deviation of participants' ages are presented in table 2. In inferential section, as pretest scores were considered as covariant variable, to determine its impact on the posttest, analysis of covariance was used. To this end, the assumptions of variance homogeneity and the normal distribution of scores- as main covariance assumptions- were investigated. The results of Levene test approved the homogeneity of the data (Auditory Discrimination: $F=29.65$, $P<0.11$; Reading Skills: $F=1.66$, $P<0.33$). The data analysis based on Kolmogorov–Smirnov test shows the normal distribution of data in both groups. Since the prerequisites for covariance were observed, the data were analyzed using the above method (The covariance results are presented in table 3). As evident in tables 3 and 4, the F values are significant for both reading skills and auditory discrimination in posttest. Table 5 shows that these values are significant for all reading subscales except for Rhyme and Reading non-words subscales. Consequently, there is a significant difference in the mean scores of reading skills and auditory discrimination between control and experimental groups- the pretest affect is controlled. The comparison of adjusted means in both groups indicates that the mean for experimental group is higher than the mean of control group in both tests and most of reading skills subscales.

The findings indicated that sound therapy with Forbrain, significantly, improved the reading skills and auditory discrimination in the experimental group compared to the control group. Although we didn't find identical studies in Iran or abroad, the results of similar studies support the present study. E.g. Mald's pioneering study (1985), indicated that auditory correction using Tomatis method (based on vibration) in male dyslexia students improved reading and spelling (cited in Moretti & et al, 2002). Corbra et al (2005) also reported that employing the voice of people suffering from chronic and acute stutter to produce corrected signals improved their speech. Guerrero (2015), Escera (2014) showed that Forbrain headset helps to reduce students'

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reading difficulties. Layeghian et al (2013) showed that games improving auditory skills can boost the capacity of auditory-explanative memory, sharpen auditory discrimination, and improve dictation of students with learning disorders.

Since the paths of visual and audial are totally connected in brain, and both are engaged in reading, training and adjusting listening is a way to improve reading performance. Poor listening skills are main obstacles to grow lingual skills. When spoken sounds are not perfectly conveyed to the children, they will face problems in converting sounds into lingual symbols. The right ear is the leader influentially transferring speech sounds to brain, because the right ear is directly connected with the left hemisphere- the main language processing center. Based on the reports on children suffering from reading problems, especially dyslexia, fail to achieve the right ear dominance, consequently what they hear is disordered, segmented, and uninfluential. The sometimes used the right ear, and sometimes the left one as dominant, and as a result sounds reach to the brain in different speeds, and scattered (Joadri et al 2009).

The balance between the two brain hemispheres is fundamentally important to overcome reading problems. This balance does not exist in people with reading problems, and the paths leading to thorough voice analysis are disrupted. Consequently, sound therapy is one the successful treatments for them. On the one hand, vibration stimulates and trains the ears, and ear is taught to receive and interpret information in a different way. On the other hand, the right ear is trained to be dominant, and this reduces reading problems to a large extent. So far, many studies have confirmed the effectivity of Tomatis sound therapy method (Gerritsen, 2009). They showed that this therapy can reduced reading problems or totally obviate them. The classic sound therapy model for children suffering from reading difficulties include 10 to 20 hours of auditory training with music (using vibration to stimulate hearing cortex) followed by reading aloud practice (to train the right ear dominance).

In sound therapy with Forbrain, both types of practice take place simultaneously and with a better quality. In this method, on the one hand, vibrations are made to stimulate the nervous system and bones to convey information through bones into brain and nervous system. The set

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has got a filter to improve auditory quality and the performance of vestibular system. The diffusion of sound via through bones has a significant role in emergence of phonological cycle which in turn is responsible for diffusion of stored speech information. This process leads to improvement of speech and fluency. The methods based on auditory stimulation provide the chance to increase muscular capacity of the ear (Gerritsen ,2009). The study of Pienkowski and Eggermont on cats revealed that passive and long term exposure to augmenting sounds helps to reorganize the hearing map on the cortex (Pienkowski & Eggermont, 2012; Norena et al, 2006). Scarin used audio stimulation and claimed that this method resulted in improving auditory reception and speeding up the reception of auditory signals (cited in AbediKoupaeia &et al, 2013). On the other hand, the special layout of the headset makes the right ear dominant, and this in turn facilitates the reception and processing of auditory signals. Thus, we expect plastic changes in audio-oral cycles which lead to more organized and influential transfer of auditory information to the cortex.

As a whole, it seems that, sound therapy with Forbrain improves auditory processing and discrimination in students. Correction of sound analysis paths leads to improvement in reading skills. The results obtained from this study revealed that sound therapy can be an influential and effective intervention to treat students with reading difficulties. Because of effectivity of the present intervention in treatment of auditory discrimination, the same method can be employed to treat or prevent other learning disorders. Although sound therapy is not a perfect treatment for all types of learning disorders, it is a major component since hearing plays a prominent role in learning process without its training and adjustment learning will be really hard. Some of restrictions faced in this study were limitation of research to the 2nd and 3rd elementary school grades, the lack of follow up studies because of time limitation, as well as novelty of intervention method. These factors make generalization of the findings difficult. Sampling based on the availability and ignoring age and gender are other limitations of the study. Consequently, we recommend the researchers to conduct similar studies in other regions of the country and on different educational grades so that generalization- based on the age and gender characteristics- becomes plausible.

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