**Effectiveness of Implicit Stimulation of the cerebral hemispheres based on Baker’s equilibrium model of reading in dyslexia on the reading and writing in linguistic Developmental dyslexia: A case study**

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**Abstract**:

**Objective:** this study was to investigate the effectiveness of implicit stimulation of the cerebral hemispheres based on Baker’s equilibrium model of reading in dyslexia on the reading and writing in linguistic developmental dyslexia. **Method:** A single subjectapproach was used in the present case study and two, 9-year-old linguistic dyslexic students were enrolled in the third grade available were selected from patients referred to the clinic in Tehran. Both the student were evaluated with the Wechsler Intelligence Scale for Children, reading disorder test (Nasefat, 1380) and test writing disorder (Fallah chay, 1375) And then one of the students was considered as experiment individual and other as a control. Experimental subject during 16 sessions of 30 minutes (2 sessions per week) received implied stimulation of the cerebral hemisphere, but the evidence did not receive stimulation. After the intervention and after 3 months reading and writing impairment test was answered by each student. **Results:** Results showed that the intervention implied stimulated hemispheres of the brain based on the Baker equilibrium model enhance the accuracy and reading comprehension of the experiment individual compared with matched control subject. Also the stability of implied stimulation of cerebral hemispheres was significant after 3 months in experiment subject. Conclusion: Implicit method of stimulating the brain hemisphere can improve the performance of students with dyslexia, reading and writing linguistic.

**Keywords: implicit stimulates the cerebral hemispheres, Baker’s Model, reading, writing, Developmental Dyslexia.**

**Introduction:**

Developmental dyslexia is a combination of problems that will affect the learning process in one or more areas including reading, writing and spelling and maybe is also associated with impaired auditory and visual impairment spoken language and motor skills (1). Children with developmental dyslexia have many mistakes in reading which are indicated by the wrong word removal, addition or inversion. They are in trouble in separate letters to their shape and size, their reading speed is low and often least understood (2). According to Baker (2009) preliminary reading involves perceptual analysis of the shape and orientation of letters and words. The conceptual analysis is performed by the right hemisphere. Perceptual properties of text analysis and navigation primarily stimulates is done by the right hemisphere processing. So, first read the preliminary state of equilibrium hemisphere controls the right side of the stage, the balance is tilted to the left hemisphere. Based on this model, preliminary reading and reading advanced by the left hemisphere is processed by the right hemisphere and the stage of learning to read, the displacement of the right hemisphere to the left hemisphere takes place. Based on Baker’s equilibrium model of reading, developmental linguistic dyslexia is caused by the dysfunction of right hemisphere (3) and there is problem in transfer of information from the right hemisphere to the left hemisphere (4). Some children in learning process of read are not able to transfer the right hemisphere to the left hemisphere. These children read slowly, disrupted and carefully and have no fluency in their reading. Baker called these children as P-type dyslexic due to over-reliance on perceptual features of the text. In some children, from the beginning the left hemisphere is essential in learning to read. These children try linguistic strategies take advantage of the left hemisphere, thus they ignore the context of perceptual characteristics that is leading to rapid and accurate reading. Baker classified these children as L dyslexic type (3). Currently, there is increasing evidence that the brain is ready to change through environmental stimulation. In other words, brain is able to change by receiving stimulations from learning, social and psychological environments. Thus, by stimulating the left hemisphere, P-type dyslexic reading performance in children and with right hemisphere stimulation of L-type dyslexic children's reading performance can be improved. Implementation and effectiveness of neuropsychological treatment as the most effective treatment methods have been approved by the Developmental Dyslexia (5, 6, 7, 8, 9 and 10). One of these methods is implicit hemisphere brain stimulation (HAS). This indirect method can be done by stimulating the cerebral hemispheres through the visual channel and through the choice of words and texts with different fonts and sizes. The aim is to stimulate the right hemisphere to increase the subject’s perceptual features of text and to moderate reading speed. Present research by using case study and application the implicit stimulation of brain hemisphere based on Baker’s equilibrium models of reading is to answer to this general question ,whether the use of such treatment, effective amount of students’ reading will rise or not. Does increased efficiency of linguistic dyslexic students in reading also affects the performance of his writing or not.

**Method**

This study was a case study of a single subject. Considering purpose and nature of the research subject, AB design with matched control subjects were selected for this study. The design is composed of the two time periods (period A or baseline) and the B (or trial operation period). In the baseline period, the ability to read and write in two linguistics dyslexic students, who referred to the clinic were evaluated. 9-year-old female experimental student was in elementary third grade and IQ of 107 (verbal and non-verbal, 99, 108) on the Wechsler intelligence test for children. Her socio-economic situation was moderate and in Nosfat’s reading disorder test (2001) with 32 errors in reading comprehension, one mistake in reading speed and her reading speed was 84 seconds and in Fallah chay writing impairment test(1996) she had 18 spelling mistakes. The control was a 9 years old student, studying in third grade, and had moderate socio-economic situation. Her IQ was 110 and she had 29 errors in reading comprehension, one mistake in reading acuity and her reading speed was 95 seconds and she had 20 spelling mistakes to write the exam disorder. In the present study, we used the following tools:

**Research Tools:**

1-Wechsler's Intelligence Scale for Children Disorder (WISC-R):

In order to measure the student's Revised IQ from the Wechsler Intelligence Scale for Children was used. This scale was made by Wechsler to Measure the intelligence of children produced in 1969 and has 12 subscales (six verbal subscales: and six nonverbal subscales). This scale has been revised several times in the present study the revised Wechsler Intelligence Scale for Children (11) was used. Test-retest reliability of the subscales was between 0/58 and 0/87 in the case of verbal and nonverbal intelligence interest was between 0/76 and 0/94. The half -split reliability of the subscales range was respectively from 0/67 to 0/79 in IQ levels between 0/92 to 0/95, (12).

- Nosfat reading impairment test:

In order to detect and measure the reading ability of reading disorder Nosfat test (2001) was used. This test has a text to fit any three main grade and measures clinical characteristics of the wrong reading, reading speed and reading comprehension. Based on this test, for each type of error, 1 point will be given to participants and his total mistakes considered as general error. For each correct answer to comprehension questions 1 score is awarded. Finally, the amount of time he spends from start reading the text till the end measured in seconds is considered and calculated as an indicator of the speed reading. The reliability coefficient for reading in elementary school for grades III, IV and V, respectively was 0/56, 0/61and 0/68 (13).

3 - Falah chay’s writing impairment test: This test is made by Falah chay ​​and is used to detect and measure the level of writing ability of writing impaired subjects and validity of the test 0/86 is obtained. The test has two texts for each grade that the first text covers 50% of the Persian the Second text covers entire content of Book Persian book. In terms of difficulty the test is set according to age and grade of students. Cronbach's alpha in this study has been reported 0/80 (Falah chay, 1375).

**Implication method**

After selecting 2 dyslexic linguistic type students referring to clinic and explaining to parents and students in this study, at first the written consent of the parents of children were taken Based on participating in the study, they were assured that the information obtained from them will remain confidential and Participation in the research involve no additional costs or losses for their children. Then 2 students were evaluated by revised form of the Wechsler Intelligence Scale IQ And the ability to read and write (baseline), reading disorder, and test them using writing disorders were measured. Then one student was considered as experiment to another and as a control subject. Experiment Individual received 16 sessions (30 minutes, 2 times a week) stimulated brain hemisphere implicitly with parental involvement at home. But the control individual was not present at these meetings. After the intervention, and 3 months later, read and write performance in both experimental and control individual were evaluated, and data were described using frequency tables and graphs. During the 16-session intervention, the right hemisphere indirectly through the choice of words was stimulated with different fonts and sizes. Since people with linguistic dyslexia read quickly with basic errors such as delete, add, move and replace the letters and syllables are in the word Presentation of words and sentences with different fonts and sizes for them to engage in more attention on the perceptual characteristics of the text (word recognition) and maximize your reading speed limit tempts to balance Robertson and Baker (2002). In each session, a different list of words and sentences that were similar in size and font, but gradually became more complex and longer than most of were given to the students (First and second sessions began with 5 and 6 word in the sixteenth session was 15 words.) All words, number of phonemes, and number of full-color light relief was provided. During each session, the individual once were asked to read and again smaller font larger font color and highlight. Almost at the twelfth session, there was a significant reduction in reading errors until the final session; students' reading speed was balanced. Such a long pause to read the phonemes and words was already used in meetings was omitted. To reduce spelling errors students self asking methods was used. This is part two of two almost identical sentences were presented to students some of the letters in the word incorrectly, then the students were asked to find the words to ask themselves: Do you know this word? This word is composed of several parts? The number of sections counted correctly? This word has multiple characters? Should I write words in the air? Can I write the word preserved? Do I correctly spell word? If the correct word I sing it out loud). At the end of each session, parents were given the words and sentences and they must be returned to the student to practice at home the same way and the results are reported. At the beginning of each session, again, words and sentences and practice session was over, the content of the new session will be provided to students.

**Results**

Table 1 shows the results of the efficacy of implicitly brain stimulation on the accuracy, speed, reading comprehension and effective writing of linguistic dyslexic students through the various stages of evaluation (baseline Intervention pursuit). Results of Table 1 show the frequency of errors in reading and spelling errors in the experiment (a) compared with control subjects (b) after the intervention implied hemisphere brain stimulation, has a reduction and speed reading and reading comprehension, he has risen.

Table 1- Frequency of reading and writing performance scores of 2 students in the experimental and control baseline, intervention and follow-up

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | baseline | | | | | Intervention(post-test) | | | | | | | Follow up | | | | | | | |
|  |  | | reading |  | Spelling mistake |  | | reading | |  | | Spelling mistake |  | | reading | |  | | Spelling mistake | |
| error | | speed | comprehension | error | | speed | | comprehension | | error | | speed | | Comprehension | |
| experiment | 21 | 136 | | 1 | 16 | 3 | 236 | | 5 | | 5 | | 2 | 230 | | 3 | | 6 | |
| Control | 20 | 136 | | 2 | 15 | 19 | 136 | | 1 | | 14 | | 18 | 137 | | 2 | | 15 | |

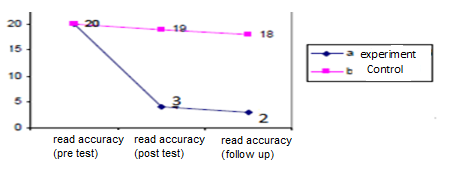


Diagram 1- Line diagram of reading accuracy of the experiment and control subject

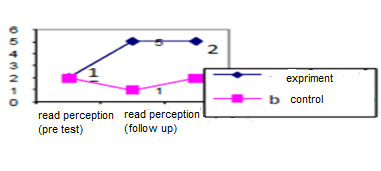


Diagram 2- Line diagram of reading comprehension of the experiment and control subject

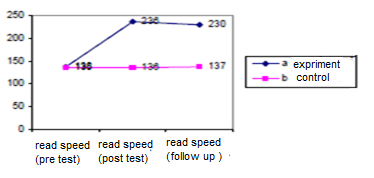


Diagram 3- Line diagram of reading speed of the experiment and control subject

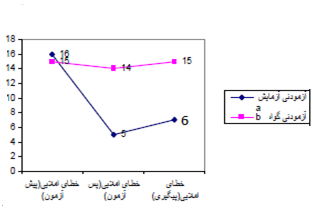


Diagram 4- Line diagram of spelling mistakes of the experiment and control subject

**Discussion**

The findings indicate that the use of implicit stimulates cerebral hemispheres leads to increase the efficiency of reading and writing in students with linguistic dyslexic students. In other words, the right brain hemisphere implicit stimulation in this study, increased accuracy and comprehension tests compared to matched control subjects and has reduced the number of spelling errors and his reading speed. These findings are consistent with the results of such studies (15, 16, 9, and 10). Given that Developmentallinguistic Dyslexia is a neurological disorder in the structure and function of the cerebral hemispheres. According to Baker (2009) both left and right hemispheres of the brain are involved in the transformation process of reading. Because reading requires an analysis of the perception of shape and orientation of letters and words and the management of the right hemisphere to the left hemisphere to be transported continue to read, read smoothly and fluently. Based on the model of Baker, reading mainly is carried out by the right hemisphere in the preliminary stages and by the left hemisphere the in advanced stages. Right hemisphere function given the task of extracting the spatial aspects of visual thinking - Space is responsible for the written word. In the beginning of reading the brain analysis, the written word in terms of its spatial and then it should be understood spatial sound and meaning. Linguistic dyslexia is caused when the transfer is not properly done. This type of dyslexia is caused by a reader in the preliminary stages of reading development; the strategy uses left hemisphere language earlier or the beginning of the reading process; the left hemisphere is the main activity. In fact, people with linguistic dyslexia rely too much on the left hemisphere and less they use the right hemisphere strategies and this leads to a high-speed reading and understanding text, it will be neglected. They are in lack of accuracy and have fundamental errors in reading. Based on the Baker’s equilibrium reading model, linguistic dyslexic children has little interest action of right hemisphere therefore it is expected stimulating the right brain hemisphere, where appropriate, probably decreases a lot of errors in reading (17). Using this technique, the brain hemisphere can be implied as a complementary therapy to meet professionals in the field of learning disabilities are active to be useful and leads them in order to improve the writing and reading performance of students with linguistic dyslexia. Limitation of the present study was the use of only two students that constraints Generalizability of the results to a large sample of individuals with linguistic dyslexia. It seems that the implied stimulation of brain hemisphere and increasing the sample size and the use of implicit methods causes to achieve dramatic results for people with dyslexia conceptual (type P), valuable findings compared read and write performance with the latter group sample results and may lead to useful pace for people with developmental dyslexia.

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