

The role of tomatis sound therapy in the treatment of difficulties in reading in children with developmental dyslexia.

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Abstract

Introduction: Music may be used as therapeutic interventions or educational practices. Tomatis method is used in treatment of children with learning disorders, autism, attention deficits disorders, developmental delays, brain injury, multiple sensory system dysfunctions. The aim of the study was to investigate which reading skills may improve thanks to treatment based on Tomatis method. The study was conducted among 78 participants (25 girls and 53 boys).

Methods: The 'Łatysz' non-word reading test was used to assess phonological aspect of language processing and the influence of Tomatis Listening Training to ability of reading.

Results: There was the relationship between proper read to all read words and visual perception ($p=0,04$). We detected the correlation between short - term phonological memory and auditory memory ($p=0,04$).

Conclusion: The smallest the ratio between proper read words to general read word the better is visual perception. The better short - term phonological memory means the higher especially auditory memory.

Keywords: Developmental dyslexia, Phonological processes, Reading skills.

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Introduction

Children with developmental dyslexia present problems in reading and other processes related to phonology aspects [1]. Nowadays, 3–11% children and adolescent suffer from difficulties in reading and others related skills [2]. If there are any dysfunctions in one of the pathways going to the frontal cortex (in particular pre-motor regions), then they might be reduced by stimulating the alternative pathway or by changing the kind of stimuli. One of the previous researches has shown the influence of music on the performance in a subsequent language task requiring syntax processing. Therefore music may be used as therapeutic interventions or educational practices [3].

The Tomatis method enables to train neuropsychological and physiological processes. Listening to specially created music programs engages the auditory pathways and cortical level and the inhibitory mechanism of the limbic and paralimbic areas [4]. The Tomatis method is used in order to estimate the aural perception. The basic assumption of the method is the fact that the hearing and listening consider not only the ear and the external stimuli but also all the activation of neural and mental processes [5]. Therapy is based mainly on music of Mozart and Gregorian Chants. The sound are perceived through bone and air conduction [1,6].

Taking into account that music is likely to bear significant

effects on synaptic plasticity we may predict that Tomatis method may support learning processes. Tomatis method which uses Mozart music and Gregorian chants may be consider as music stimulation. That is why we can suspect that it may have an impact on the connectivity of existing neurons by improvement the activation of neural circuits. Even during the most basic auditory activities circuitry is strengthened as strengthening of cognitive-sensory connectivity [7].

Nowadays Tomatis method is used in treatment of children with learning disorders, autism, attention deficits disorders, developmental delays, brain injury, multiple sensory system dysfunctions. These are some researches that children with autism did not benefit from the Tomatis. Others studies revealed that it is effective for children with autism in improvement in emotional response, nonverbal communication, listening response, adaptation to change and activity level [8]. What is more some researches showed significant improvements in sensory processing, receptive/expressive listening and language, motor skills, and behavioral/social adjustment at the post-intervention assessment.

The aim of the study was to investigate what areas of learning to read may improve thanks to treatment based on Tomatis method. The other challenge was to determine whether reading skills improves thank to Tomatis training in children with developmental dyslexia

Material and Methods

The study called received the resolution of the Ethics Committee number 80/16 14th January 2016. The name of the project was: “The meaningfulness and importance of training auditory attention for the development of linguistic competence in children at risk of dyslexia”. The study was conducted among 78 participants (25 girls and 53 boys). There were sixteen pupils who lived in a village. Others lived in small town, or cities. Most of the participants in the study had typical, ordinary system of learning. Just three children had individual system of learning.

The inclusion criterion contains:

- 1) Developmental dyslexia
- 2) The level of IQ intelligence quotient (IQ) of <70 on the Wechsler-Bellevue Intelligence Scale

There were some exclusion criteria:

- 1) Diagnosed chronic diseases
- 2) Any mental diseases
- 3) Epilepsy
- 4) Taking any drugs
- 5) Parents’ disagreement
- 6) Attention-deficit/hyperactivity disorder diagnosis

The Latysz non-word reading test was used to measure phonological aspect of language processing and the impact of Tomatis Listening Training to ability of reading.

The Latysz non-word reading test contains 71 non-words’ tasks. All of them have varying difficulty [9]. They follow the rules of phonology and morphology. The amount of words read correctly in black and white cards during 60 s, was measured. The other measurement was made: the number of non-words read correctly, without any distortions, divided

Table 1. Descriptive statistic of components of fluid intelligence.

Value	Min	Max	M	SD
visual perception	3	17	9,24	3,35
auditory memory	1	17	9,18	3,51
selective attention	1	18	7,98	3,76
phonological memory	4	19	10,90	3,64
Visual-spatial memory	1	16	9,76	3,57
Spatial understanding	4	19	11,85	3,23
Conceptual understanding	4	19	10,71	3,38

Table 2. The relationship between the components of reading skills and fluid intelligence, Pearson's correlation coefficient with P-value, $p < 0,05$.

Feature	Visual perception	Auditory memory	Selective attention	Phonological memory	Visual spatial memory	Spatial understanding	Conceptual understanding
Number of proper read words (Latysz test)	0,13	0,19	0,30**	0,09	0,22	0,13	0,28*
Number of all read words (Latysz test)	0,10	0,19	0,32	0,10	0,22	0,10	0,26*
The relationship between proper read to all read words (test Latysz)	-0,04	0,21	0,07	0,18	0,17	0,01	0,13
Short-term phonological memory (zetotest)	0,12	0,04	0,16	0,38	0,29	0,08	0,24
Auditory synthesis (phonological skills)	0,10	0,35	0,05	0,24	0,28	0,18	0,18
Auditory analyzis (phonological skills)	0,12	0,23	0,06	0,24	0,20	0,19	0,15
Words differentiation (phonological skills)	0,23*	0,28	0,35	0,21	0,24	0,15	0,15
Short term memory	0,35**	0,44	0,26	0,30	0,35	0,37	0,33

by the total number of non-words. The maximum score is 1 (all words read correctly). Another parameter which was taken into account was short-term memory. Comparison between phonological memory and phonological ability with components of fluid intelligence was done. We tested how factors associated with reading relate to aspects of memory.

Results

Firstly the components of fluid intelligence were scored among children. The score are shown below (Tables 1 and 2).

If the index of proper read words to general read words to visual perception was negative it means the smallest the relationship the better visual perception.

Discussion

There are many methods which may improve learning processes including reading skills in children with developmental dyslexia. There are also many aspects of reading which should be taken into consideration in order to improve learning. For instance, phonological memory. It is one of the most important phonological skill, which has not been studied in much detail. However it is well known in general acknowledge that it takes part in gaining abilities during period of learning at school [10]. Phonological processing deficit, for instant deficits in phonological memory was consider as important factor which may be related with poor reading skills in present study.

There are just few hypotheses that deficits in phenomenon awareness skills, such as phenomenon memory may be related to developmental dyslexia [11]. Similarly visual perception dysfunctions may interfere with developmental dyslexia. Although they were considered separately in the past, nowadays they are viewed as being related to each other. One of the effects of Tomatis stimulation was the improvement in phonological memory while auditory memory as an aspect of fluid intelligence also increased. The importance of phonological memory describing as the short-term storage of phonological speech sounds was mentioned as digital in learning not only reading. Phonological memory is also correlated with an averaged arithmetic score. The role of phonological memory may be measured with a repetition task containing non-words tasks. Phonological short-term memory is also considered as one of the unique aspect in multiplication ability, despite of individual differences in intellectual ability and general reaction time [11].

Another aspect that improves after Tomatis therapy was selective attention with connection to auditory synthesis. The selective attention is described as the ability to limit the distracting effects of background sound entering the higher auditory system through the inferior colliculus. Selective attention is very important especially when there are some distractors shown in speech in noise test, speech in reverberatory environments. Selective attention is promoted by the binaural interaction of information because it enables to ignore masking noise. It is possible because the mechanisms of attentional selectivity affect generators ipsilateral and contralateral to the attended ear. What is more the descending control of selectivity is possible thanks to olivocochlear projection. It could mediate the selection at the level of the cochlear nucleus. It should be mentioned that selection occurs prior to the first bifurcation of the ascending auditory system including an ascending projection to the superior olivary complexes of the contralateral hemisphere. The attentional selectivity does not need the segregation of attended and ignored stimuli to both sides of the brain [12]. The components of fluid intelligence such as selective attention supports successful performance of the task by constructing the effective action plans [13].

Many researchers have investigated that auditory training help in therapy children with reading difficulties [14]. However it is obvious that reading is also related to visual skills. The correlation between proper read to all read words and visual perception was shown in present study. This is a hypothesis that special part of the brain, for instance the left midfusiform gyrus (ImFG) reflects visually organized information about words [15]. Reading skills are represented as grapheme-phoneme activation in cortical areas involved in phonological processing and areas involved in visual processing, such as the visual word form area (VWFA) in the left lateral occipitotemporal sulcus [16].

Difficulties at school should be considered as early as it is possible because they may produce low self-esteem. Increased prevalence of anxiety disorders (20%) and depressive disorders (14.5%) may also be found in young persons with reading disorder. Reading as an example of the skill gaining at school, enables children to participate in public life. The intervention for pupils should last as long as is needed because the longer duration of the intervention the greater improvement in reading [2].

Conclusion

The smallest the ratio between proper read words to general read word the better is visual perception. The better short-term phonological memory the higher the auditory memory. If children have better auditory synthesis (phonological skills) than the better is selective attention.

To sum up, these are some spheres in reading skills that improves after Tomatis therapy, especially short – term phonological memory if the auditory memory is good and auditory synthesis if the selective attention is better and the amount of proper read words.

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