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The role of speech therapy in the therapy of children with central hearing disorders Rola logopedy w terapii dzieci z centralnymi zaburzeniami przetwarzania słuchowego

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Summary

Central disorders of hearing processing are one of the main causes of school difficulties among children. CAPD is described as incapability of using auditory acoustic sounds with its correct perception within ambit structures. The disorder is often accompanied by such difficulties as dyslexia, specific learning problems or subnormal speech development. Early diagnose of the disorder and commencing a therapy allows a child a better adjustment to expectations which he or she is exposed to by its environment. The aim of this work is indicating the role and abilities of a speech therapist while treating CAPD children. Aural

training is adequate for children with central auditory disorders and in order to be effective it should be long lasting, intensive and adjusted to a child's individual abilities. Therapy should include both passive listening of sounds and exercises in which the child can actively participate. The aim of speech therapy is to develop auditory skills, speaking, communication and stimulating cognitive potential of a child. Among the auditory exercises conducted by the speech therapist are understanding distorted speech exercises, understanding distorted speech in the presence of a jamming signal, separation and integration of information exercises, localization and lateralization exercises, recognizing sound patterns exercises, recognizing sound sequences exercises, differentiating nonverbal stimuli and phonemes exercises and prosodic training. Therapeutic auditory training that is carried out systematically develops aural and linguistic competences.

Key words: *speech therapist, therapy, central auditory processing disorders*

Streszczenie

Centralne zaburzenia przetwarzania słuchowego stanowią częstą przyczynę powstawania u dzieci trudności szkolnych. CAPD określa się jako niemożność pełnego wykorzystania słyszanego sygnału akustycznego przy prawidłowym jego odbiorze w strukturach obwodowych. Zaburzeniu towarzyszą takie trudności jak dysleksja, specyficzne trudności w uczeniu się czy też opóźniony rozwój mowy. Wczesne wykrycie zaburzenia oraz rozpoczęcie terapii umożliwia dziecku lepsze przystosowanie się do wymagań stawianych przez jego środowisko. Celem pracy jest wskazanie roli i możliwości logopedy w terapii dzieci z CAPD. Trening słuchowy przeznaczony dla dzieci z centralnymi zaburzeniami słuchu, aby był efektywny powinien być długotrwały i intensywny oraz dostosowany do indywidualnych możliwości dziecka. Terapia powinna obejmować zarówno bierne słuchanie dźwięków jak i ćwiczenia, w których dziecko mogłoby aktywnie uczestniczyć. Celem działań logopedy jest rozwijanie umiejętności słuchowych, rozwijanie języka, komunikacji i stymulowanie możliwości poznawczych dziecka. Wśród ćwiczeń słuchowych prowadzonych przez logopedę znajdują się ćwiczenia rozumienia mowy zniekształconej, ćwiczenia rozumienia mowy zniekształconej w obecności sygnału zagłuszającego, ćwiczenia separacji i integracji informacji, ćwiczenia lokalizacji i lateralizacji dźwięku, ćwiczenia rozpoznawania wzorców dźwiękowych, ćwiczenia rozpoznawania sekwencji dźwięków, ćwiczenia w różnicowaniu bodźców niewerbalnych i fonemów oraz trening prozodyczny.

Systematycznie prowadzony logopedyczny trening słuchowy rozwija umiejętności słuchowe i językowe u dzieci z diagnozą CAPD.

Słowa kluczowe: *logopeda, terapia, centralne zaburzenia przetwarzania słuchowego*

Introduction

In recent years the increase of diagnose interest and central auditory processing disorders has been noticed. Current knowledge concerning incorrect absorbing and interpreting sounds from the surrounding world is vital in case of understanding the nature of school difficulties and what is more their diagnosis and undertaking speech supporting exercises. According to American Speech, Language and Hearing Association- ASHA recognition of central auditory processing disorder can be ascertained when merely one of the following hearing function is disturbed: localization of sound source, differentiation of sounds, model sounds recognition, the ability of understanding disordered speech, the ability of understanding sounds which are drowned out, temporary auditory signals aspects including: time resolution, preceding and following masking, time integration, sound perception ordering [1]. J.Katz developed more general notion describing central auditory processing disorders as incapability of using hearing acoustic signal with its correct reception within peripheral structures [2]. In contrast, Fuente and McPherson[3] defined central auditory processing disorders as hearing illness deriving from abnormal brain activity which can be characterized as incorrect differentiation, separation, grouping, localization and stimuli ordering. Diagnosis of the disorder bases on hearing functions evaluation.

Central auditory processing disorders are not homogenous disorder group and they do not restrict merely to hearing problems in other words to incorrect audial information processing. CAPD is often accompanied by difficulties such as dyslexia, specific learning difficulties or delayed speech development. Inappropriate cognitive functions, for instance, operational memory, attention and other language functions also have huge impact. That wide variety of disorders connected to CAPD are detrimental to numerous aspects of children functioning and may cause school, communication and social relations difficulties [4].

According to Musiek [5] central auditory disorders cover from 2% to 5% of children population at age 7 to 10, and undetected and untreated significantly reduce the development and learning opportunities of these children.

Early diagnose and treatment commencement is crucial and it allows better and earlier adaptation to expectations the child is exposed to. The role of a speech therapist is preventing the aftermath of auditory disorders through prevention and therapeutic intervention. The speech therapist tries to make the child interested and eager to exercises. The advantage of individual exercises with a speech therapist give the chance to follow the progress and to choose difficulty level customized to a particular child.

The aim

The aim of this work is indicating the role and abilities of a speech therapist while treating CAPD children.

State of knowledge description

DIAGNOSIS

In order to diagnose CAPD disorders it is necessary to evaluate auditory behaviors. Bellis [6] advises two stages diagnostic process for CAPD. First step containing screening, preliminary research and the second one in the form of upper auditory functions in case of confirming such disorders.

Children who were diagnosed with auditory processing disorders often have difficulties with understanding longer and complicated verbal instructions. They might have problems with understanding speech in noisy environment. Some problems with focusing the attention on the given task, remembering new data, days of the week, months, learning poems by heart or multiplication table, may occur. These are children who are as intelligent as others. Nonetheless, learning by ear difficulties can influence linguistic efficiency, the ability to read and write and thus, it reduces school results.

Children with these symptoms indicating auditory processing disorders are initially referred to specialists such as a speech therapist, educator or psychologist. The role of a speech therapist at this stage is to measure linguistic effectiveness, auditory functions as far as speech perception is concerned and to analyze given data about functioning of the child in school environment. The task of a speech therapist is to obtain information from parents

concerning difficulties that were observed and to determine how communication development, cognitive and motor processes were developing. A speech therapist through screening treatment can use such questionnaire as The Scale of Auditory Behaviors and The Fisher's Auditory Processing Problems Checklist [7].

When a result of screening diagnose auditory processing disorder is confirmed, a therapist direct the child to specialistic unit in order to conduct behavioral and electrophysiological tests. An audiologist's visit should precede the examination at a psychological clinic to assess the child's intellectual ability.

Diagnose of upper auditory functions is conducted through: pure tone audiometry, speech audiometry, impedance audiometry and otoacoustic emissions. It is performed to reject ambit auditory disorders which might cause hearing difficulties. In order to evaluate central processing of auditory data it is important to conduct electrophysiological tests like ABR (Auditory Brainstem Response), MLR (Middle Latency Responses) and registering potential long latency wave P300 [8].

Central auditory processing disorders is also diagnosed by behavioral tests which are divided into three groups:

1. Understanding distorted speech test
2. Binaural integrity and separation test
3. Tests for temporal aspects of hearing development and short-term auditory memory

In the understanding distorted speech tests the patient has to recognize modified speech sounds. Words can presented in the presence of a disturbed signal, distorted in frequency and distorted in terms of presentation time.

Binaural integrity and separation tests measure the ability to combine some information presented to both ears at the same time DDT (Dichotic Digit Test) [9] or to focus on a piece of information given to one ear while ignoring the information given to the other ear which is played at the same time (Staggered Spondaic Word Test). The tests examine conducting of signals between cerebral hemispheres, dichotic integration and divisibility of attention.

The third group evaluates short term auditory memory and the ability to differentiate DPT (Duration Pattern Test) and FPT (Frequency Pattern Test) of three sounds sequence. The ability to detect noise gaps is also investigated using the GDT (Gap Detection Test) [10].

The therapy

When behavioral and electrophysiological tests confirm diagnose of central auditory disorders, an adequate therapy should be started. An audiologist tries to diagnose should give necessary information about available forms of treatment: auditory training, therapeutic training developing hearing perception and about hearing supporting systems (FM) which can supplement treatment. Auditory training designed for children with central auditory disorders impairment to be effective it should be long lasting, intensive and adjusted to a child's individual abilities. Therapy should include both passive listening of sounds and exercises in which the child can actively participate[11].

The most common therapeutic programs are: Tomatis method, Johansen's IAS, Auricula Training Method, Samonas Sound Therapy method, Listening Fitness according to Paul Madaule, Auditory Integration Training according to Guy Berard and Warnke's method. All the auditory trainings above improve not only auditory processing but also understanding of speech, reading, articulation, communication and ability to keep attention and concentration on verbal information. Nonetheless, it is worth to remember that auditory trainings are one form of therapy which consists of speech, pedagogical and psychological therapy.

Another specialist who takes part in a child's therapy as far as central processing disorders are concerned is a speech therapist. He has a lot of important functions in the treatment process. His aim is to develop auditory abilities, speaking, communication and stimulating cognitive potential of a child. His role is also to convey directions for parents and teachers how to adjust audial environment in the classroom so as to minimize noise and facilitate learning.

The outcome of the behavioral test conducted by a speech therapist allow to evaluate precisely which auditory functions of a child require improving and to what extent. On the basis of the data obtained in the course of the diagnose, a speech therapist sets a therapy plan and a training that targets toward an exact deficit.

The list below presents a set of audial exercises that a speech therapist conducts:

1. Understanding distorted speech exercises
2. Understanding distorted speech in the presence of a jamming signal
3. Separation and integration of information exercises
4. Localization and lateralization exercises
5. Recognizing sound patterns exercises
6. Recognizing sound sequences exercises
7. Differentiating nonverbal stimuli and phonemes exercises
8. Prosodic training

Understanding distorted speech exercises consist of filling the gaps in the text with words, syllables or single phonemes. A speech therapist can use some poems and songs that the child is familiar with. In case of problems, prompts and some guidance is allowed. A therapist may give a child first letter of any word or introduce dictionary exercises which might be helpful in decoding a particular word. When a child learns the ability to use contextual information, speech distortion can be introduced in the presence of a jamming signal. For this purpose, the therapist speaks to the child's mind or asks a question, while in the background hear radio or other distractors. The task of the child is to correctly repeat the sentence or answer the question asked.

Separation and binaural integration exercises during speech therapy are conducted in cooperation with three persons: a parent, a child and a therapist. In the test, the sound delivered to each ear changes depending whether a child has to pay attention only to the sound coming to one ear (separation) or to both ears (integration). At the beginning a correct message deriving from a therapist should be loud enough that a child could hear it easily but at the same time he or she has to be aware that another ear is simultaneously exposed to a competitive prompt. The correct sound is being delivered to weaker ear, which is usually left one, while the stronger ear is being exposed to the competitive stimulation. Depending on the exercise the intensity of the messages is changed. The exercise can be performed in the form of a funny game. The therapist and the parent deliver information to both ears at the same time asking where the toy was hidden. The therapist says to one ear "go, search it", while the parent says "in the wardrobe". The difficulty level can be increased. The child's one ear is exposed to a story while the other ear hears contradicting sounds. The goal of the child is to summarize the story. Bellis [12] advises that the exercises are performed approximately 20-30 minutes a day. Another training that is suggested by Bellis is sound localization training. It is mostly used when a child does not progressing in the therapies above. His exercises can be

lead in the way that there are some loudspeakers in the room. Exercises may consist in the placement of speakers and the presentation of verbal and non-verbal stimuli in an isolated manner or in the presence of a competitive message. The child has to point to the speaker which plays the desired sound.

Yet another exercise that a therapist can perform with a child who was diagnosed with central auditory processing disorder is recognizing standard patterns training. The aim of this training is to recognize the sequence of sounds, analysis, and imitation rhythmic patterns. At first, those could be short, three elements sequences which can be tapped, clapped or played on a musical instrument. The role of the child is to point whether the auditory patterns exposed in pairs are the same or different. It is worth manipulating with the length of pauses between the sounds, their volume and rhythm. The training may begin with nonverbal material presentation and then use a sequence of words in which the child has to point out one word which is different from the rest.

Children who were diagnosed with differentiating speech sounds difficulties are advised to take up verbal and phonemic audial stimuli differentiation. The objective of the exercise is to measure frequency, the volume and the sounds' duration. For example, the child has to say if he or she hears one or two stimuli. This exercise can also be presented in a form of a game. The child has to utter the word that was played twice, for example, window, wind, door, window. Phonemes differentiation training is an activity where a child perform some activities to strengthen its phonological awareness [13]. At first, the child learns to recognize phonemes which sound similar in isolation, then in syllables and at the end a full word. The final stage is associating a phoneme with its graphic representation and a particular letter.

During auditory training with a speech therapist children learn to recognize prosodic aspects of speech: rhythm, accent, intonation. First, the words, which accent while speaking changes their meaning, are introduced. The training has one rule that imposes exaggerating the accent, the intonation at the beginning of the training and gradually moving into natural way of speaking. This process depends on how fast the children progress. There might occur some problems in detecting the most important pieces of information given in verbal communication. In that case, it is advisable to perform key words extracting training. Sometimes children with central auditory disorders read monotone voice, without emotion, and then practice reading aloud with appropriate intonation [11]. In such situations a microphone or special Forbrain headphones usually work well.

All auditory exercises conducted under a therapist supervision should be adjusted to individual abilities of any child. When the little patient copes with the task well, the difficulty level ought to be increased. However, if the child does not cope with the task, the therapist needs to go back to easier auditory exercises.

Conclusion

1. CAPD children should have their auditory functions stimulated.
2. In the therapy, there should be five subjects involved: audiologists, speech therapists, pedagogues, psychologists and children's parents.
3. Therapeutic auditory training that is carried out systematically develops auditory and linguistic competences.

References

1. Senderski, A. *Diagnostyka centralnych zaburzeń przetwarzania słuchowego. Algorytm postępowania diagnostycznego*; 2002.
http://ifps.org.pl/doc/material_dydaktyka/senderski2.pdf [10.09.2017]
2. Kurkowski, Z. M. *Zaburzenia przetwarzania słuchowego*. w: Grabias, S. Kurkowski, Z. M. *Logopedia. Teoria zaburzeń mowy*. Lublin: Wydawnictwo UMCS; 2012.
3. McPherson B., Fuente A.: *Ośrodkowe procesy przetwarzania słuchowego: wprowadzenie i opis testów możliwych do zastosowania u pacjentów polskojęzycznych*. *Otolaryngologia*, 2007; 6(2): 66–76.
4. Milner, R. Ganc, M. Czajka, N. Trzaskowski, B. Piotrowska, A. Kurkowski, Z. M. Kochanek, K. Skarżyński, H. *Zastosowanie terapii neurofeedback w poprawie wyższych funkcji słuchowych u dzieci z ośrodkowymi zaburzeniami słuchu-wyniki wstępne*. „*Audiofonologia*”, 2012; 1(1): 69.
5. Chermak G. D., Musiek F. E.: *Central auditory processing disorders – New Perspectives*. Singular Publishing Group, San Diego; 1997.
6. Bellis T.J.: *Assessment and management of central auditory processing disorders in the educational setting: from science to practice*. Cengage Learning; 2003.
7. Fisher, L. I. *Learning disabilities and auditory processing*. In R.J. Van Hattam (Ed.), *Administration of speech language services in schools: A manual* San Diego, CA: College-hill Press; 1985; 231-290.

8. Szmeja Z, Sekula A, Wiskirska-Woźnica B, Wojnowski W. *Ośrodkowe zaburzenia słuchu*. (w) *Audiologia kliniczna – zarys*. Pruszewicz A, Obrębowski A (red.). Wydawnictwo Naukowe UM w Poznaniu, 2010: 453-60.
9. Musiek F.: *Assessment of central auditory dysfunction: the dichotic digit test revisited*. *Ear Hear*, 1983; 4: 79–83.
10. McPherson B., Fuente A.: *Ośrodkowe procesy przetwarzania słuchowego: wprowadzenie i opis testów możliwych do zastosowania u pacjentów polskojęzycznych*. *Otolaryngologia*, 2007; 6(2): 66–76.
11. Skoczylas, A. Lewandowska, M. Pluta, A. Kurkowski, Z. M. Skarżyński, H. *Ośrodkowe zaburzenia słuchu- wskazówki diagnostyczne i propozycje terapii*. „*Audiofonologia*”, 2012; 1(1), s. 14-17.
12. Bellis T.J.: *Assessment and management of central auditory processing disorders in the educational setting: from science to practice*. Cengage Learning, 2003.
13. Sloan C.: *Treating auditory processing difficulties in children*. San Diego, CA: Singular Publishing Group, 1995.