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The Role of Family and School Environment in Therapy of Children with Central Auditory Processing Disorder

SUMMARY

More and more patients are presenting with a clinical suspicion of Central Auditory Processing Disorder (CAPD). In order to make a correct diagnosis, it is necessary for an interdisciplinary team of experts to conduct thorough tests and carry out a reliable analysis of their results. CAPD is a problem diagnosed in patients with normal hearing sensitivity; moreover, their difficulties do not result from cognitive or linguistic impairment, although they can co-occur with these conditions.

Specialists recommend three complementary approaches which can improve the functioning of children with CAPD. One of these strategies is to modify their home and school environment. This article provides elaboration on this issue; it also shows the role of the immediate environment in the therapy of a child with CAPD. The guidelines it offers are also useful in the therapy of patients with hearing perception problems.

Key words: central auditory processing disorder (CAPD), noise, school, music

INTRODUCTION

Central Auditory Processing Disorder (CAPD) is still a new issue in Poland. However, around the world, scientists have been studying it since the 1950s. The problem was first described in “Central hearing processes”, a publication by Bocca and Calero (Fuente, McPherson 2007).

Despite many years of research, it is only modern techniques that enable definite diagnosis and treatment of central auditory processing disorders.

Currently, the frequency of the disorder is estimated to be 2–3% among children and 10% among adults.

TERMINOLOGY

In Poland, the most commonly-used term for the problem is *central auditory processing disorders*; however, a few other terms are also in use, namely: *central disorders of hearing*, *disorders of auditory processing*, *central disorders of hearing processes*, *disorders of central auditory processing*. The terms encountered in the English-language sources are *Central Auditory Processing Disorder – CAPD* and *Auditory Processing Disorder – APD*. The abbreviations *CAPD* and *APD* are also used in the Polish terminology (Kurkowski 2015).

There is no definitive definition of the disorder in question. It is assumed that the most commonly-used one is that offered by the American Speech-Language-Hearing Association – ASHA: *a deficit in the neural processing of auditory stimuli that is not due to higher order language, cognitive, or related factors* (ASHA 2005).

In 1996, ASHA published a list of difficulties whose occurrence can indicate CAPD. Scientists claim that CAPD may be an underlying problem if one or more of the functions listed below are impaired:

- auditory localization and lateralization,
- auditory discrimination (distinguishing between two or more auditory stimuli and recognizing the similarities and differences between them),
- auditory pattern recognition,
- the perception of temporal aspects of the signal (temporal discrimination, masking, integration and temporal ordering),
- auditory performance in competing acoustic signals,
- auditory performance with low redundancy acoustic signals, i.e. when the amount of information necessary to convey and receive the message is reduced through filtering, time compression or presenting the signal in noise (Keith 2004).

Central auditory processing disorders are sometimes mistaken for SLI (Specific Language Impairment), dyslexia, dyslalia, ADHD, ADD and aphasia; it is therefore important to perform a differential diagnosis. It also needs to be emphasized again that CAPD is only diagnosed in cases in which the patients' hearing sensitivity is normal and their hearing difficulties are not due to impairment of cognitive or linguistic functions (Senderski 2014).

Owing to such serious diagnostic difficulties, Kurkowski (2017) proposes that a division into specific and non-specific auditory processing disorders should be considered. Thus, specific disorders would be diagnosed in the absence of peripheral hearing disorders, language development disorders or cognitive disorders (they would only refer to auditory problems), while non-specific disorders would include associated disorders affecting several modalities. Such a division

is extremely important since in practice the boundaries between auditory perception difficulties and central auditory processing disorder are becoming blurred (Kurkowski 2017).

SYMPTOMS

A number of symptoms of central auditory processing disorder are listed in sources concerning the problem. The most commonly mentioned ones include (Majak 2013; Rostkowska 2013):

- difficulties with understanding speech in noise and in unfavorable listening conditions (for instance, in rooms with high reverberation times, in classrooms, while the radio or TV is on or next to an open window),
- difficulties with understanding distorted speech (for instance, speech which is not clear, speech distorted due to reverberation, local dialects),
- difficulties with understanding and carrying out verbal commands,
- difficulties with remembering information received aurally,
- frequent requests for repetition, distorting messages received aurally,
- confusing similar-sounding sounds, words (of similar frequencies or duration),
- difficulties with sound and syllable analysis and synthesis (despite practice),
- difficulties with locating the source of sound,
- becoming distracted quickly and easily, poor attention concentration,
- difficulties with learning to read,
- poor results in learning the Polish language and foreign languages,
- poor musical abilities, unwillingness to sing or play instruments,
- oversensitivity to specific sounds, inadequate reactions to sounds,
- fear of sounds, feeling stressed about sounds,
- problems with correct articulation (despite the provided logopedic therapy).

The above-listed difficulties are not the only problems facing patients with CAPD. It should be emphasized, however, that not all of the enumerated symptoms occur in every patient; consequently, patients with CAPD are not a homogeneous group, their symptoms and difficulties may differ. Depending on the dominant deficit, specialists distinguish three subtypes of the disorder:

- with a prosodic deficit – the dominant problems include difficulties with: discriminating non-verbal sounds, temporal pattern perception (for example, rhythm perception), understanding the speaker's intentions, understanding irony and jokes;

- with an auditory decoding deficit, characterized by: difficulties with temporal processing of information and with discriminating sound pitch, problems with understanding distorted speech and with understanding speech in noise, confusing similar sounds, poor vocabulary;
- with an integration deficit, characterized by: difficulties with understanding speech in noise and with integrating semantic information with prosodic clues, problems with locating the source of sound, motor coordination and auditory-visual-motor coordination (Skoczylas 2012, Zaborniak-Sobczak 2016).

Depending on the dominant deficit, different forms of therapy are recommended. In practice, the difficulties characteristic of the listed subtypes very often co-occur and the therapy measures should be tailored to each individual child.

DIAGNOSIS

A full diagnosis of central auditory processing disorder requires the cooperation of a whole team, which should consist of an audiologist, a logopedist, a specialist in pedagogy, a psychologist, a GP, and the patient's parents and teachers.

Undoubtedly, audiological results are of key importance: firstly, they exclude hearing impairment and secondly, they indicate the type of difficulties with sound processing on higher levels of the auditory pathway which the patient experiences. Nevertheless, the diagnosis should be made by the whole team of specialists who will also establish a differential diagnosis. Logopedic and psychological tests as well as an assessment of sensory integration processes should be conducted (Przybyła, Kasica-Bańkowska 2012).

An interdisciplinary team of specialists assembled in this way can make an accurate diagnosis. The child's parents or guardians and teachers play a highly significant role during the process of diagnosis and then during therapy. It is the parents who provide detailed information concerning the course of pregnancy and labor, the child's psychomotor and auditory development and the occurrence of auditory difficulties which arouse their anxiety. Teachers, on the other hand, offer their assessment of the child's functioning at school, his or her achievements in terms of reading and writing, foreign languages and musical skills.

Parents and teachers are the first to notice children's auditory difficulties. Available screening tests, such as *The Scale of Auditory Behaviors – SAB*, *The Fisher's Auditory Processing Problems Checklist – FISHER*, *The Children's Auditory Performance Scale – CHAPS*, can prove to be a useful tool (Krzyszewska 2015). The parents' or teachers' answers which indicate the occurrence of auditory difficulties provide the basis for further diagnostics.

The minimum test battery for assessing higher auditory functions (according to Senderski) includes:

- adaptive speech in noise (ASPN) test,
- frequency pattern test (FPT),
- gap detection test (GDT) and binaural interaction test.

Despite the fact that the children diagnosed with central auditory processing disorder need specialist care and therapy, the condition itself is not included in DSM-IV or ICD-10.

FORMS OF THERAPY

A lack of properly made diagnosis and failure to provide therapy may have a negative influence upon, among others, academic results and produce reading and writing difficulties, which, in turn, may affect the child's self-esteem and sometimes even cause disturbed behavior. Therefore, it is necessary to undertake all measures aimed at ensuring the child's healthy development. To achieve this a team of specialists is required who will cooperate with one another and, once a thorough diagnosis is made, will recommend a suitable form of therapy tailored to the child's results and abilities at the given time (Paczkowska 2013; Majak 2013).

Specialists in the field of therapy of central auditory processing disorder propose several mutually-complementary solutions that produce the expected therapy effects and translate into improvement in the child's functioning at home and at school.

Bellis (2003) (Kurkowski 2015; Rostkowska 2013) recommends three approaches in the therapy of CAPD:

1. auditory training based on the plasticity of the nervous system, aimed at developing the auditory functions that are disturbed (for instance, the Tomatis Method, K. Johansen's Individual Auditory Stimulation – IAS, the Warnke Method, Neuroflow – active auditory training, GoBrain therapy – playing with sounds);
2. modification of the child's school environment so as to create better conditions for aural reception of information (improving the quality of classrooms, creating conditions favorable for listening, educating teachers, introducing FM systems);
3. teaching the child to use strategies compensating for the auditory deficits (psychological or pedagogical therapy which helps in communication and learning as well as orients the patient towards listening; teaching the patient to use strategies useful in learning; exercises to boost memory, concentration and decision-making speed).

Thus, the therapy of central auditory processing disorder cannot be based upon a single element, for example, auditory training, as such therapy activity would be fragmentary and insufficient. The role of home and school environment is important in the therapy process. Sometimes the therapy must include socio-therapeutic and psychological work. Rostkowska (2013) claims that therapy should involve two forms of therapy measures:

1. direct therapy (developing listening, language, social, communication and emotional skills);
2. indirect therapy (psychological activity, such as support groups, therapy groups, psychotherapy, educating parents and teachers) (Rostkowska 2013).

The present article is a discussion of the aspects connected with home and school environment, their role in the therapy process and in education as far as handling children with CAPD is concerned. It is home and school environment that have the greatest influence on the development of a child who – as a result of his/her problems – often becomes shy, frustrated, withdrawn, his/her interpersonal communication is impaired and who is frequently perceived as lazy and naughty. All this results from lack of diagnosis of the child's problem and poor awareness of the difficulties caused by CAPD among parents and teachers (Rostkowska 2013).

MODIFYING THE HOME ENVIRONMENT

It is immensely important to create acoustically-favorable conditions for a child in this/her most immediate environment, in the place where s/he spends the most time, i.e. at home. If it is the child's own room, it should be silent. It is worth considering sound-absorbing items – a soft carpet, wall-to-wall carpeting on the floor (preferably wooden), window curtains, scattered cushions; it might also be worth covering the walls with wallpaper that is as rough as possible. Adding a bookcase filled with books and removing all the glass surfaces, such as glass-topped coffee tables or glazed cupboards, will improve the acoustics in the room.

If the parents can choose the location of the child's room, they should consider the room located far from “noisy places”, i.e. the bathroom and the kitchen.

It is also worth considering the noise coming from the outside: cars driving by, ambulances, neighbors' conversations, the TV playing too loudly. This kind of environment is not favorable for listening, and sometimes the noise exceeds the level assumed to be “acoustically comfortable”. Such an environment definitely impedes learning or even makes it difficult for the child to understand what is said to him/her. It is therefore necessary to take care of the child's working space

– switch off the TV and computer and create a quiet learning environment. What is more, this space must be well-lit, the desk and chair need to be suitable for the child's height, the unnecessary things (toys, the phone) should be removed from the desk while all the things needed for work (pencils, pens, a ruler, etc.) can be kept handy. The time for studying, homework, reading should be appropriate to the child's condition (Wojtera 2013).

The Polish norms stipulate that the level of noise considered to be permissible in living spaces should not exceed 35dB during the day (i.e. from 6 a.m. to 10 p.m.) and 25dB during the night (i.e. from 10 p.m. to 6 a.m.). In the kitchen and other sanitary rooms the noise level should not exceed 40dB, regardless of the time of day (PN-87/B-02151/02).

Studies conducted by Provincial Environmental Protection Inspectorates between 2007 and 2011 show that the comfortable noise level is notoriously exceeded. The problem occurs more frequently at night, which undoubtedly affects relaxation and sleep and, consequently, causes lowered efficiency, tiredness, irritability, sleepiness, worse physical and mental condition (Lis 2015).

The groups most vulnerable to sleep disturbances caused by noise include elderly people, people suffering from sleep disorders, schizophrenics, autistic people, patients with tinnitus, and shift workers. Scientists also claim that although in children the threshold for waking up is higher (by ca 10dB than in adults), children are more vulnerable to physiological changes such as increases in blood pressure and excessive body movement during sleep. Thus, considering the changes which occur in childhood, this group is also particularly at risk from night-time noise (Pawlas 2015).

THE QUALITY OF SIGNAL

Parents should also be conscious of the way they communicate with their child. It is important to ensure that they talk to the child when she or he is in the same room, face the child and speak in a way which encourages the child to listen. Eye contact helps to receive and understand the message that is why while talking to a child it is necessary to look at him/her. The manner of speaking is also important, one should not speak too loudly or too quietly and the pace of speech ought not to be too fast.

In the case of children with central auditory processing disorder, the important information should be highlighted by comments such as "This is important", "Pay attention", "Listen carefully". If the child was diagnosed with difficulties with processing sounds, simple and unambiguous messages should be formed; it is also advisable to verify whether the child has understood the message by asking him/her to say what s/he remembers.

AUDITORY EDUCATION

One of the methods used in therapy is auditory education delivered by parents, i.e. introducing the child into the world of sounds. In this way children practice concentrating on the auditory stimuli they hear, work on noticing differences between sounds and learn to identify and locate sounds. The heard sounds should provide a pretext for talking about them, simple guessing games can also be used for this purpose – what was the sound?, how did it sound?, what did it mean?

Another way of spending time that facilitates therapy is reading books to the child and then asking him/her to retell the story. In the case of children with more serious auditory difficulties visual prompts could be used – the mother or father reads a story, the child listens and looks at the pages with illustrations.

In some situations audiobooks could be used; however, it is the parent's live voice which is a more valuable sound signal.

It is also worth trying to engage in some joint storytelling and doing auditory memory exercises such as learning short poems by heart or repeating nursery rhymes.

MUSIC-MAKING

Learning to play a musical instrument, especially a melodic one, i.e. an instrument which can produce both rhythm and melody, is the best stimulation for the development of higher auditory functions. It helps shape manual skills, visual-auditory-motor coordination, movement-planning, the ability to notice different aspects of sounds, concentration on the activity being performed; it develops memory, imagination and thinking skills. Music education also aids language learning and many forms of auditory training use music, for instance, classical music or Gregorian chants, in the therapy of central auditory processing disorder (Borowiecka 2015; Majzner 2013).

Research conducted by Kraus proves that only 6 weeks of learning to play a musical instrument has positive influence on the results of higher auditory functions tests (Song 2012).

Research conducted on a group of children in which some received music education and some did not, also shows that learning to play a musical instrument has beneficial effects. The children who received music education had significantly better results in higher auditory functions tests; music education also positively influenced academic achievement (Kruczyńska, Kurkowski 2012).

Majak (2016) reached similar conclusions: according to her, musicians – students of the Academy of Music, achieved better results in tests assessing higher

auditory functions than members of the control group – students of Logopedics (Majak, Śliwińska-Kowalska 2016).

In the case of children with central auditory processing disorder, one-to-one musical instrument tuition is the best solution; during lessons the pace of work will be tailored to the child's current abilities.

The family environment should also create opportunities for the child to engage in active music-making. Research shows that a non-musical family environment affects the child's reactions – or, in fact, lack of reaction – to music. If the parents are not interested in music, if they do not sing or play musical instruments, the child will also show no interest in music-making (Mirkiewicz 2010).

Therefore, the best way of combining therapy with play is spending time making music together as a family: dancing, singing, doing karaoke, rapping (creating rhymes), and lullaby-singing. Thanks to such activities children practice focusing on listening, learn to notice various aspects of sounds (noticing the presence or absence of sound, discriminating pitch, duration or tempo), exercise their auditory memory by trying to remember song melodies and lyrics. Such exercises are an excellent way of stimulating the development of higher auditory functions (Kurkowski 2017).

It also seems advisable to use rhythm and aspects of sound connected with pitch in therapy and music education of children with CAPD in the same way as in the case of children with dyslexia-type problems. Such music exercises can have a positive effect as far as learning to read and write is concerned (Lawendowski 2016).

It is worth combining music exercises with movement by introducing such activities as dancing, music and movement games, gymnastics accompanied by music, telling stories through movement, movement improvisations. The suggested exercises are highly significant in hearing and speech therapy due to the fact that music and speech have many elements in common (rhythm, melody, pace, intensity, articulation, timbre, phrasing, accent, pause). Music and movement exercises develop visual-auditory-motor coordination, vitality and aptitude for music and movement; they improve the respiratory, phonatory and articulatory organs and enhance the development of speaking and understanding speech (active and passive skills). Furthermore, they have a beneficial influence upon the sense of security and self-esteem, help shape sensitivity and empathy, contribute to well-being and affect behavior (Bogdanowicz 2012, Konarczak-Stachowiak 2016).

In some subtypes of CAPD (especially in the case of children with integration deficit) dancing, juggling, karate or gymnastics lessons can prove helpful. The positive qualities of juggling are used as an auxiliary form in education and in therapy of, among others, dyslexia, since juggling teaches patience, develops the ability to divide attention, activates and synchronizes the hemispheres, positively affects memory and concentration, and consequently improves academic

results. Scientists have noticed its beneficial influence on, *inter alia*, learning to read and write. As far as juggling is concerned, it is also worth taking its rhythmic nature into account; that is why utilization of music as background for exercises is recommended. Numerous schools around the world have introduced juggling as a form of Physical Education (Wójcik 2010).

In the case of patients with dominant integration deficit it is recommended that their sensory integration should be diagnosed and – depending on the results – appropriate sensory integration therapy should be administered (Borowiecka 2015).

MODIFYING THE SCHOOL ENVIRONMENT

The American Speech-Language-Hearing Association reports that the level of noise in the classroom in which a child with diagnosed CAPD is learning should not exceed 30dB while the reverberation time ought not to be longer than 0.4s. The signal-to-noise ratio should not be lower than +15dB. This is a recommendation for pupils with CAPD; however, it seems that it will also improve other pupils' functioning. Unfortunately, studies conducted show unambiguously that the recommended level is rarely observed (Knychalska-Zbierańska 2016).

Research proves that the noisiest periods are breaks and Physical Education classes, when the level of noise exceeds 80–90dB. During school classes the level of noise is between 53 and 77dB and the values depend on the type of class; the noisiest classes are common room activities as well as Music, Art and Design and Technology (DT) lessons. The beginnings and endings of lessons are considerably noisier.

The average level of outside noise which comes into classrooms from all noise sources is 40–50dB. It therefore exceeds the recommended level of 30–40dB, which does not influence the reception of the teacher's speech. The level of noise is also considerably higher in primary than in secondary schools. In the Polish schools the level of noise in corridors during breaks is higher by ca 20dB compared to foreign schools (Augustyńska 2009).

Such a high level of noise results from both internal and external factors. The external factors include the location of the school close to heavy road, air or railway traffic as well as playgrounds and sports grounds placed nearby. The internal factors are, primarily, the pupils' and teachers' activities as well as all the devices in the building (Augustyńska 2009).

The fact that the recommended level of noise is exceeded adversely affects the functioning of all pupils and especially of the children suffering from hearing problems. They then face even greater difficulties with comprehending the teacher's verbal messages in lessons, which may negatively influence their understand-

ing of instructions, learning process, auditory learning and, consequently, lead to lower grades. Tiredness and irritability caused by noise may affect solving tasks based on language skills, memory and the ability to focus attention (Polewczyk 2014, Kochanek 2013).

Noise can negatively affect not only the hearing organ. All these unwanted, unpleasant, annoying acoustic stimuli influence the whole of the person's body. Depending on the intensity of the noise and the time of exposure, they may adversely affect the nervous system, lower visual acuity, hinder the understanding of speech, unfavorably influence relaxation, make hearing less acute, cause headaches, and reduce the effectiveness of working and studying. Furthermore, noise levels beyond 85dB may be hazardous to human health (Kozłowska-Szczęśna 2004).

Radosz (2012) writes that studies on reverberation time show that only 1 percent of classrooms meet the Polish norms. The optimum reverberation time affects the understanding of speech and the level of acoustic background noise in classrooms. Longer reverberation times translate into the teacher's extra vocal effort when conducting lessons, which may lead to the development of occupational diseases among teachers (Radosz 2012).

The Polish schools struggle with the problem of noise and acoustically unfavorable conditions in classrooms, corridors, canteens and gymnasiums. The problem is most frequently connected with the inappropriate interior finish of classrooms and with their equipment. Soundproofing of classrooms and elimination of reverberation are the most beneficial solutions. This can be achieved with the use of special sound-absorbing materials. Sometimes identification and removal of devices that emit unnecessary sounds, such as computers, projectors, fans, can improve the acoustic conditions in the room. The level of classroom noise is also significantly affected by the number of pupils participating in the lesson – the best conditions are observed in classes with no more than 20 pupils (Augustyńska 2009, Radosz 2012).

THE PUPIL'S SEAT IN THE CLASSROOM

The seat which the pupil occupies in the classroom is also extremely important. In order to facilitate the reception of information given by the teacher, it is most beneficial for a pupil with CAPD to sit in a place from which s/he can easily (at an angle of less than 45 degrees) watch the teacher's face (from the distance of 2-3m); however, this does not need to be in the front row of seats. The place needs to be carefully chosen so that the pupil will not be distracted by other sounds and situations (for instance, the views and sounds from a window). It is also worth considering all the small elements, such as the loud ticking of the clock, the

hum of the air-conditioner, classmates' conversations. Pupils often face difficulties with selection, with concentrating attention on the most important sound (in this case the teacher's voice) against the background of competing noises (Kurkowski 2013).

THE QUALITY OF THE TEACHER'S VOICE AND THE WAY OF TEACHING LESSONS

It is difficult for children with CAPD to find their way in the traditional model of school education. During lessons pupils are required to listen and take notes at the same time, which is extremely demanding for a child with CAPD. A good solution would be to provide notes/presentations earlier so that the children can familiarize themselves with them before the lesson and focus on the information conveyed aurally while the lesson is being taught. Another way of solving the problem would be to enable the recording of lessons into a Dictaphone so that later the material can be analyzed and notes can be made (Kurkowski 2013).

During classes it would be good to accompany the material conveyed aurally with visual stimuli, which would increase the child's general level of attention. Visual materials which could be used for this purpose include photographs, graphs, diagrams, tables, pictograms, etc. (Kurkowski 2013).

Important information ought to be preceded by comments such as "this is going to be important", "listen", and "pay attention". During the lesson the teacher should verify that the pupils have understood the material being taught: ask them to recount what they remember and check if they understand the discussed issue accurately. When introducing new material it is worth writing down the keywords connected with it. Discussing a new issue, the teacher should repeat the same things several times, sometimes rephrasing them, use visual aids such as illustrations or a presentation, and pay special attention to the prosodic features of the message (intonation). The child will benefit more from the use of multimedia. Each topic and task should end with a short summary, which can take the form of highlighting the main points and emphasizing the things that must be remembered (Kurkowski 2013).

Children with CAPD feel tiredness relatively quickly. In their case, listening requires significantly more effort and concentration, as a result of which they cannot focus on listening in all their lessons. This is why it is vital that the teacher should carefully plan the way s/he conveys information. More challenging parts of the material could be alternated with less aurally demanding ones. It is also advisable to schedule the lessons of Polish language and foreign language lessons for the morning (Kurkowski 2013).

While working with a child with CAPD, it is extremely important to build their self-esteem. The child will find energy and motivation to continue studying provided that their teacher forms a good relationship with him/her, makes him/her aware of his/her strengths and understands the nature of the child's disorder. This is immensely important as many parents of children with CAPD claim that teachers lack awareness of and knowledge about the disorder.

It is vital to keep eye contact with the audience (teachers should not convey important information aurally while they are writing on the blackboard and their back is turned to the class).

The posture of the speaker is also crucial as bad posture impedes correct voice production. To achieve proper phonation one has to be aware of their posture. The posture must be perceptibly relaxed, loose and natural; it is necessary to feel balance between tension and relaxation in the whole body, not only in the phonatory organs. The relaxed posture is one that is active, flexible and naturally straight (Tarasiewicz 2006).

While conducting a lesson it is necessary to maintain the appropriate speed of speaking (one should avoid speaking too fast) and voice intensity (one should avoid speaking too quietly). It is also advisable to remember about alternating voice intensity, which will help keep the listeners focused. The important information should be signaled by intonation and sometimes repeated. It is good to use natural gestures to emphasize the message being conveyed, but it should be remembered that excessive gesturing may distract the audience's attention from listening (Senderski 2014).

FM SYSTEMS

If it is not possible to adapt the classroom to meet the needs of pupils with CAPD, one might consider providing them with electronic systems which enhance hearing. FM Systems are most beneficial to people who suffer from the dominant auditory decoding subtype of CAPD. They are a group of patients characterized by: 1) difficulties with understanding speech in noise as well as fast, distorted or unclear speech; 2) poor and short auditory memory; 3) the low level of the ability to select auditory stimuli (Knychalska-Zbierańska 2016).

However, Kurkowski (2013) claims that FM Systems should only be used when new information is being conveyed as children with CAPD ought to function unaided (in the natural environment) as often as possible so that they can themselves (i.e. without help from devices) try to detect signals which are significant for them (Kurkowski 2013).

FM devices improve the clarity of speech (for example, the teacher's voice) against the background noise. The benefit results from the fact that the signal

reaches the child's ears directly while reverberation and noises interfering with the signal are eliminated. Research shows that pupils using FM Systems reported fewer difficulties in comprehending lessons; their concentration of attention also improved considerably and so did their academic results, which translated into higher self-esteem and enhanced confidence (Senderski 2014).

The most modern systems are significantly better at analyzing interfering sounds and adjust the appropriate amplification of the signal by the receiver than the old, analogue ones. The systems amplify the speaker's voice and at the same time reduce background noise which impedes the understanding of the message (Knychalska-Zbierańska 2016).

Research shows that after using an FM system even for several months children feel a considerable difference as far as understanding speech is concerned; in some cases this was also connected with a change in behavior. The children became less timid and lost, they also made friends more easily. Moreover, other results also showed considerable improvement in school grades, especially in terms of reading fluency (Knychalska-Zbierańska 2016).

It may be said that FM Systems have a positive impact on and enhance:

- concentration of attention,
- understanding of speech,
- academic results,
- changes in behavior,
- self-esteem,
- well-being,
- emotional condition.

CONCLUSION

The improvement of the functioning of a patient with central auditory processing disorder involves, *inter alia*, modifying their home and school environment. It is insufficient to provide only auditory training, for example, as it is also necessary to introduce changes to the environments in which the child spends most of his/her time, i.e. their home and school. Enhancing the quality of stimuli (the teacher's voice, the parents' voices), improving the acoustic conditions (eliminating reverberation, soundproofing the classroom and the child's room) and altering the ways of spending leisure time (singing, music-making, dancing) are simple actions which will aid the therapy of a child with CAPD.

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