

EEG Biofeedback in individuals with multiple disability in Slovakia

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Abstract: *This contribution discusses the possibility of application of neurotherapy carried on through EEG Biofeedback in Slovakia. A part of this contribution consists of partial research results carried on in the whole territory of Slovakia. One of the research goals was mapping the basic characteristics and the course of neurotherapy realized through EEG Biofeedback (neurotherapists' qualification, diagnosis qualification, clients' age, success rate in the area of sensomotorics, EEG Biofeedback in individuals with multiple disability etc.). Represented results were being found by means of questionnaire survey. In the conclusion the contribution contains brief casuistry of child with multiple disability.*

Key words: *neurotherapy, EEG Biofeedback, individuals with multiple disability, Down syndrome*

1 Introduction

During recent years a greater attention has been paid to the EEG Biofeedback in our conditions. It's increased application has been more apparent from sixties of the 20th century. It represents not only the acquisition of new information in basic areas of research, e.g. research of neurobiologic mechanisms of organism in the area of neuroplasticity, but also its application and its use in numerous indications apart from ADHD, ADD, epilepsy, autism etc. A more recent field, in which EEG biofeedback may be of good use is multiple disability. However, this issues still suffers from lack of interest both worldwide and in Slovakia. This fact is proved by thin volume of professional publications not only in our country but also on a global scale. From this reason, we tried to find by research investigation more data and conditions of EEG

Biofeedback application in Slovakia. First in general, then in the area of application in individuals with multiple disability. More detailed findings are presented below.

2 Theoretical implications

Theoretical implications concern the multiple disability and the field of neurotherapy carried on through EEF Biofeedback in general and with regard to the multiple disability.

Multiple disability

More recent definitions of multiple disability reflect influence of new paradigms, changes in philosophy and approach to these people. Overall, a man as a human being is emphasized, he should be approached holistically and all modalities creating his entity should be taken in consideration. Numerous definitions are characteristic in descriptive manner. The authors accentuate the extent of support, care from society and environment where individuals live, possibilities to assert in their life, development of personality in the process of education or individual's positives and strong traits.

Vašek (2003, p. 37–38) identifies the term “multiple disability” with formation of new quality of disability different from simple sum of present handicaps and disabilities. He explains this new formation of quality from the perspective of interactions and mutual overlapping of participating handicaps or disabilities, thus so called synergic effect, i. e. new quality of disability is formed. In author's opinion, this multifactorially, multicausally, and multisymptomatologically conditioned phenomenon determines substantially individual functionality of individual's compensating mechanisms. In simplified form, it expresses relations between individual factors that affect and determine multiple disability as follows: $MD = f(D_1, D_2, \dots, D_n, Sye, Cm)$. The result of this pattern expresses that multiple disability (MD) is function of concurrence of participating disabilities or handicaps ($D_1, D_2, \dots, D_n$), synergic effect (Sye) and compensating mechanisms (Cm).

Vašek defines “the multiple disability” also from special educational point of view as data flow disorder. This author's implication (2001, p. 163–164) originates from above mentioned findings when he states, that “*basically, it is about possibility of receiving, processing, preserving and operating the data within limited sensoric canals or difficulties associated with transformation of data to knowledge due to mental disability, as well as communicative difficulties due to expression disability*”. Simply, the difficulties associated with multiple disability *may occur in reception of data, in its central processing, expression or combined. In general one can state that multiple disability may occur in various numerous combinations in which inter-individual differences require*

strictly individual approach. Afore mentioned implications and definitions are used by other Check colleagues such as Vítková (2006), Ludvíková et al. (2005) and others.

Neurofeedback, EEG Biofeedback

Tyl, Sedláková (1996), Palatová (1999), Tyl, Tylová (2003), Bálint (2006), Hammond (2006), Haward-Jones (2007) and others briefly define neurofeedback as monitoring of human brain activity with perspective of chance to influence it. It is a manner in which brain waves are managed through biologic feedback based on operant conditioning. Many studies use the terms like neurotherapy, neurofeedback, EEG biofeedback, brainfitness, taking them for synonyms.

Striefel (2004, quoted by SABN, 2010) alleges the differences between the terms neurotherapy, neurofeedback and EEG biofeedback. He considers neurotherapy a clinic application of EEG Biofeedback, biofeedback of blood flow (HEG), audiovisual stimulation (AVS) and other suitable practices designed to change the cortical activity in order to achieve visible benefit. It is based on paradigm of psychophysiological self-regulation, self-transaction, "I see" phenomenon, but without reduction of operant conditioning model. Then he states that neurotherapy is mostly applied as separate training method, usually 2–3 times weekly with duration at least 35–40 min. On the contrary, neurofeedback is considered to be a concrete, separate therapeutic modality. Neurofeedback uses electroencephalographic (EEG) biofeedback, feedback of blood flow (homoencephalogram HEG), audiovisual stimulation (AVS) and other practices (CT, fMRI) in order to change the cortical activity, to change the consciousness, to modify physiological and psychological functioning. The term neurofeedback does not imply medical model and it is often associated to such application as peak performance training, specific performance optimisation and others. The author considers EEG Biofeedback a direct process of operant conditioning, in which client uses feedback from specific EEG parameters (frequencies, durations, amplitudes) in order to modify biophysical and electrophysiological operations of own brain.

January 10, 2009 International society for neurofeedback and research (ISNR) and its headquarters ratified definition of neurofeedback. The definition is of more descriptive and lengthy feature, hence we mention only some sections (ISNR, 2010). Neurofeedback (NFB), similarly to biofeedback uses monitoring tools, which provide detailed data on every single moment of individual's physiological functioning condition. A feature that differs NFB from other forms of biofeedback consists in focusing on central nervous system – the brain. The essence of the NFB training is based on both findings about brain in the area of applied neuroscience and varied data clinical practice. Except for brain activity, individual's behavioural, cognitive and subjective aspects are taken into consideration in NFB, thus necessity for holistic approach to individual in his bio-psycho-social context is met. The introduction of neurotherapy

application requires assessment of brain activity (e. g. QEEG, EEG, fMRI...) and individual's psychological condition.

Most common indications are ADHD, ADD, autism, defects in autism spectrum, epilepsy, specific defect in learning (dyslexia, dyscalculia...), various addictions, post traumatic disorder, depressions, sleep disorders, pains, brain injuries and others (Tyl, 1997, Tyl, Tylová, 2003, Janský, 2006, Niv 2013, and others). However, if changes in neurons are taken into consideration, neurofeedback affects and induces change in EEG activity frequency and amplitude, what may influence acceleration of CNS maturation. Thus it is possible to assume a considerable success and asset of neurotherapy even in the areas of psychopathology, various disorders, handicaps and disabilities like diagnoses displaying multiple disability (compare Drtlíková, 2007 quoted by Gabarík, 2011). Professional literature rarely discusses the issues of EEG Biofeedback application in multiple disability. This is proved by current significant lack of theoretical and practical findings concerning EEG Biofeedback application in particular group of people both worldwide and in Slovakia. Given the character and substance of multiple disability, it is not surprising. In research it is very difficult to meet requirements from the perspective both of the methodology and creating homogeneous experimental and control group.

Apart from epilepsy or autism, cases of child cerebral palsy belong to most primary published casuistries relating to other diagnosis displaying multiple disability. Experts from Germany, Austria and Italy – Neuper, Müller, Kübler, Birbaumer a Pfurtscheller (2003), in order to establish communication through computer, successfully attempted to influence the production of brain waves of 32 years old man with cerebral palsy on the basis of EEG and computer interface. A year later (2004) Bachers, psychologist and director of Neurofeedback Foundation publishes a case of 13 years old boy with child cerebral palsy who experienced significant improvement in behaviour, reduction of aggressiveness, improvement in communication, experiencing, reduction of excessive neuromuscular irritability and overall intellectual and emotional self-possession. This was achieved following 200 sessions, in fourteen days lasting intervals, with 20 minutes session durations, with localisations on central sensomotoric band. After 4 years the boy experienced increase in IQ by 24 points (IQ 72) in verbal part of WISC-III. The same year Margaret Ayers (2004) published in USA her most successful case of a boy called Jamie (9 years old) who could not speak, was blind, could not read Braille script, with cerebral palsy, by school staff taken for autistic and severely intellectually retarded and not capable to learn. Similarly to Bachers, the author applied neurotherapy on sensomotoric cortex with progressive inhibition of theta brain activity. The author does not describe in more detail duration and length of therapy, but she refers to positive changes in speech and motorics. The boy began to speak, feel, compose the music, dance and play the piano.

Another area (study) is EEG Biofeedback applied in 7 children with Down syndrome, aged 6–14 years, who participated in 60 sessions. The training began with inhibition the delta and theta and following decreased amplitudes of these frequency bands SMR and beta activity was increased. Surmeli, Ertem (2007), a psychiatrist and psychologist from Istanbul, Turkey declared positive changes particularly in the speech area, memory, attention, behaviour and balance of these children. Later, in 2010, the above mentioned authors published another study of 23 participants with Down syndrome with medium mental retardation, aged 7–16 years. Based on numerous diagnostic methods (QEEG, WISC-R, DPC-P, TOVA) they found out significant improvement in almost all participants not only in parental questionnaires but also in improvement in exact results like results QEEG and DPC-P. They also pointed out that despite two cases did not display improvement in total IQ, improvement was achieved in individual subtests, what can be considered a success, too.

Also Yu, Kang, Jung (2012) from South Korea researched changes of brain waves and cognitive functions in children with cerebral palsy through neurofeedback. 28 children divided into experimental and control group were provided this therapy which consisted of 30 min. long sessions 2× weekly during 6 weeks. Both groups recorded statistically significant differences in spectral frequency by 50 %. Similarly, statistically significant differences were displayed in experimental group in all subtests LOCTA (Loewenstein Occupational Therapy Cognitive Assessment) in comparison with control group.

In Slovakia, there are two generations of professionals occupying with the issues of neurofeedback. It is an older generation represented primarily by Dr. Krivulka who as one of the first introduced and applied this therapy in the territory of Slovakia. He trained many neurotherapists working in various territorial units of our country. He rather recommended application of EEG Biofeedback in ADHD, ADD, tinnitus, specific learning disabilities etc (SABN. 2010). During recent years a new group of professionals stemming from speech therapists, psychologists, special educationalists, parents of handicapped children and others has been creating. This creation happens under the supervision of young, skilled neurotherapists representing so called new biofeedback generation, an institution called Biofeedback Institute Ltd. (newgenerationbiofeedback.eu). This organisation operates internationally (Checko-Slovak) – in Check towns Jihlava, Prague, Stonařov, in Slovakia in Therapeutic centre Bibiana in Prešov and it provides training of high quality in this area. Right this institution is one of the few that occupies with individuals with multiple disability. In its practice it has many skills with severely and deeply mentally (multiple) retarded persons. In the conclusion of this article we cite brief casuistry by Mgr. Bibiana Naďová, clinical speech therapists, brainfeedback therapist, EEG laboratorian working in Prešov in Therapeutic centre Bibiana and in Biofeedback Institute Ltd. in the Check republic.

3 Research

Considering the partial amount of data on EEG Biofeedback application in Slovakia in general and its application in special education and in pedagogy of individuals with multiple disability we carried on a research in December 2012. One of the primary goals of the research was to find out current status of application of neurotherapy carried on through EEG Biofeedback and possibilities of its use in intervention areas of special education in Slovakia (primarily in counselling centres focused on the work with pupils with health disabilities). The area of our interest was also the extent to which EEG Biofeedback was applied in individuals with multiple disability and in which parts of life it brought benefit etc. The principal method for data collecting was exploration method – a questionnaire distributed to various institutions and to experts from various areas.

In the initial phase of our research we focused on educational counselling and prevention school institutions, www.uips.sk, department of clinical speech therapy, licensed departments of clinical pedagogy, licensed departments of special pedagogy, neurological ambulances, organisations within the competence of Ministry of Health of SR as well as on certificated therapists in the area of psychophysiology – neurofeedback and biofeedback and psychologists registered in Association of Psychologists. From these organisations and experts we selected those using EEG Biofeedback (EEG BFB). Then we addressed 280 organisations and experts (of which 204 were educational counselling and prevention school institutions). 168 subjects of total number answered that they did not use Biofeedback (of which 146 were educational counselling and prevention school institutions), 35 subjects did not answer at all and 77 organisations stated they used EEG Biofeedback (of which 24 were educational counselling and prevention school institutions), what is 48,05 % return (in view of educational counselling and prevention school institutions, the questionnaire return was 55,81 %). Total number of respondents was 46. Despite low return we decided to assess the gained data. Hypotheses were verified through statistic software “R”: MS Excell. Testing of all hypotheses was based on central limit theorem by which transformation of binomial variables can be limit considered as normally divided variable. P-value was calculated by normal division distribution function. Zero hypothesis was accepted on 5 % level of significance, i. e. if p-value is $\geq 5\%$, zero hypothesis is accepted, otherwise rejected.

Research questions and hypotheses

The research questions focused on four areas: course and manner of EEG BFB application in general in Slovakia then in individuals with multiple disability, therapists' attitudes to this therapy, and benefit of EEG BFB for clients. For the purposes of this article we select two hypotheses. First hypothesis was as follows: neurothera-

pists – special pedagogues work more with individuals with multiple disability than neurotherapists – psychologists. Second hypothesis: neurotherapists working with individuals with multiple disability consider neurotherapy carried on through EEG biofeedback more ineffective in comparison with other neurotherapists.

Results

From the collected data we select the following. In questionnaire research we found out that EEG BFB was more frequently used in private institutions (63,04 %) than in state owned ones. Most of respondents came from Prešov county (26,09 %), least from Banská Bystrica county and Trnava county (6,52 %). EEG BGB is used mostly by women (86,69 %). Most frequently stated age of therapists was 50–60 years (30,43 %), but also aged 30–40 years and 40–50 years (26,09 %). From the perspective of primary qualification there was prevalence of pedagogy professionals (43,38 %), followed by professionals – psychologists (36,69 %). Other professions like speech therapists, doctors, health care workers, or other qualifications were represented similarly (6,52 %). EEG BFB is applied most frequently in diagnoses: F90–F98 Behaviour disorders and emotional disorders originating mostly in childhood and in youth (ADHD, ADD, behaviour disorders...) – 93,33 %, F81 Specific disorders of school faculties development – 60,00 %. Diagnoses often displaying multiple disability are represented as follows: G40 epilepsy – 11,11 %, F84 pervasive developmental disorders (autism, autism spectrum disorder) – 17,77 %, various injuries – traumas, inflammations, post stroke conditions, brain palsy and other paralytic syndromes (G83), mental retardation (F70–F79) – 26,67 %. Interesting is a fact that 13,33 % of respondents deal with speech and language developmental disorders, developmental dysphasia or stuttering. Other diagnoses or indications are neurotically or stress conditioned and somatomorphic disorders (F40–F48) – phobia, anxiety, depression, other mental disorders like emotional unstableness, organic mood disorders, migraine (24,44 %), addiction syndrome (4,44 %), burnout syndrome (4,44 %), sleep disorders (13,33 %), others (26,67 %). A non-clinical area belongs to indication, too – sportsmen, managers etc (13,33 %). Categories by age which are provided EEG BFB most frequently are as follows: 6–10 years (7,47 %), 11–15 (54,35 %) – i. e. school age of children. It is pleasing that respondents stated even pre-school age – less than 6 years.

In the second group of questions we provided EEG BFB in individuals with multiple disability. We were interested if neurotherapists worked with multiple disability and if they did, in what manner. We found out that 21 of 46 respondents (45,66 %) worked with multiple disability, most frequently two times weekly (71,43 %) with longest session lasting 40–49 min (83,33 %). Most frequent number of sessions were 100 with duration approximately 1 year and longer (47,05 %) what is closely related to length of practise of neurotherapists. Concerning the life of clients, they benefit

from EEG BFB mostly in education (70 %), behaviour (60 %), personal and home life (60 %). Therapists point out the possible contraindications, e. g. extreme restlessness, incomprehension of instruction, incapability to focus, dysfunctional family, severe mental retardation etc. A remarkable opinion is the presence of “contraindication” in the form of “bad therapist” what is proved by numerous facts coming from our research. For the purpose of modification of EEG BFB training, respondents state necessity for application of special-educational principles and methods, adjusting the environment or adapting the training, but they do not state more detailed characteristics. One of biggest troubles related to multiple disability are troubles with clients with multiple disability and necessity for individual approach.

The third and fourth part of this article include issues on the respondents’ opinion about effectiveness, parental view or indications of concrete changes of their clients. 44 of 46 (95,65 %) respondents consider EEG BFB effective with identifying most common changes in behaviour improvement, reduction of impulsivity, hyperactivity and somatic restlessness. The object of study was also the sensomotoric area, where 73,91 % respondents register positive changes. The changes mostly related to grapho-motorics, visual differentiation, auditory memory, fine motorics or improvement in spatial orientation. 84,62 % respondents – parents view the EEG BFB positively. In addition, the parents claimed lack of information on this therapy in the public or people having inadequate expectations. Neurotherapists also mentioned increased demands on parents (regular session attendance, financial coverage of the therapy etc.). Another observation is that parents experience sceptic or negative attitude of neurologists, psychiatrists or other physicians. It should be noted that the respondents encountered negative parental attitude towards the therapy what might result from above mentioned “contraindication” in the form of inadequate neurotherapists’ qualification. The overall attitude of neurotherapists to the EEG BFB is similarly positive – 78,57 %. Only one respondent claimed the contrary. Another opinion consists in comprehension of complex approach to client and not overestimating the therapy and the necessity for improving one’s professionalism or cooperation and motivation of clients and their parents. In the first hypothesis we came to the conclusion that according to test of normal variable p -value equals to 12,96 %, what is more than 5 %. On the basis of this result, we cannot reject the zero hypothesis that neurotherapists-special educationalists does not work with individuals with multiple disability equally or less then neurotherapists – psychologists. The first hypothesis has not been proved correct.

In the second hypothesis we assumed that neurotherapists working with individuals with multiple disability consider this therapy carried on through EEG Biofeedback more effective compared to others neurotherapists. In the similar we detected p -value 11,47 % greater than 5 %. From this reason it was not possible to reject zero hypothesis that neurotherapists working with individuals with multiple disability consider

the neurotherapy carried on through EEG Biofeedback equally ineffective compared to other neurotherapists. The second hypothesis has not been proved correct, too.

4 Conclusion and discussion

The research results indicate several important moments. First, there is a lack of institutions focusing on the EEG Biofeedback in Slovakia. Most of them operate in private area where client must pay for the services. We know from the experience that parents having children with multiple disability often come from poorer social conditions. Obligation to pay for service considerably limits possibilities of use of the therapy. Given this fact, however, it is necessary to realize a shift in the general perception of providing the services by providers, businessmen, public as well as the view of providing the services in other countries of European Union and all the world. These highly specialized services are much more developed in other countries than in Slovakia. Surprising is that EEG Biofeedback is mostly used in the eastern Slovakia, especially in Prešov county. On the beginning of the research we assumed that neurotherapy would be mostly used in economically more developed regions of Slovakia like Bratislava country. The results indicate that Bratislava country belonged to counties with the least number of institutions using EEG BFB.

The issue concerning the financing, service availability and their applicability is closely related to state legislative conditions and adjustment of various systems designed for state functioning. During recent years we can see the deepening gap between private and state sector. Therefore it is necessary to appeal more to state authorities and institutions for further optimization the functioning of individual sectors, thus increase life quality of people.

Another view on low number of institutions providing EEG BFB is related to necessity of high professionalism demanded from therapists, necessity of interdisciplinary knowledge, cooperation with other experts, sufficient patience and assertiveness, all these encountering numerous obstacles. In according to respondent cooperation with physicians, neurologists is often problematic and connected with great scepticism resulting from insufficient knowledge about the topic. Another topic for discussion is the general public awareness of the neurotherapy and reparation the negative opinion about its ineffectiveness.

In view of special education it is pleasant that EEG BFB is dealt with mostly by experts from this area, possibly psychologists. Thus we can assume covered necessity of individual approach to clients with ADHD, ADD, as well as individuals with multiple disability. Despite this, experts point out the problems concerning applicability of concrete methods, techniques or special educational principles in their practice. Thence the necessity for further education and supply new, clearer findings and their

usage in the area of multiple disability-related pedagogy. Another point of interest for neurotherapists is demand for data in this highly specialized area of neurotherapy. Here we can see necessity for connection several sectors like medicine, health care, pedagogy, psychology and others, all this in the form of discussions, courses, lectures carried on in the educational institutions.

In addition, on the basis of respondents' statement we can polemise the quality of provided trainings concerning the biofeedback and neurofeedback. From numerous telephone interviews and from own experience we can confirm that there exist many trained experts in neurotherapy who took the trainings for inadequate and sketchy. This finding results in question that how it is possible and which institution provides know-how of high quality. What do to with trained ones who invested much money any efforts but do not work with this therapy right due to mentioned reason? One of the solutions may involve various educational activities focused on completion the necessary knowledge and gain adequate erudition in applying this therapy.

Similarly, it is evident that almost all neurotherapists describe positive effects and asset of neurotherapy in broad range of diagnoses. This may result in more economic investment the finances on drugs, health care accessories etc. and more effective providing health and special educational services. Taking into consideration the fact that significant improvement in brain activity functioning in such severe diagnoses like central nervous system disorders, posttraumatic conditions, child cerebral palsy etc. happens within one year (how much sooner in less severe diagnoses) and that how much money end efforts is spent on the help these people we can express the opinion that with proper application of EEG BFB, faster and more effective use of their potentials and increase in their life quality may happen. Given this fact an idea occurs that expert working with multiple disability burnout very quickly just due to very low feedback on provided interventions from their clients. In case that experts see the improvement and their work fruitful in shorter period, we assume that they will have more motivation, enjoy and sense of success.

There are many areas which can be discussed, however, for the purpose of this article, we consider the above mentioned as sufficient for further reflecting and inferring further steps towards the progression. One of the steps is necessity of further research.

Casuistry

As a demonstration of EEG Biofeedback with multiple disability we select a case study of a child, carried on by Mgr. Bibiana Naďová in Biofeedback Institut in Prague. The child is 8 years old girl with diparetic child cerebral palsy, light retardation, strabismus, auditory disorder, delayed speech development, impulsivity, hyperactivity.

Personal history: a child from 2. pregnancy without complications, premature birth (26th week) without complications, too. For a small birth weight, prematurity

and the complications in postnatal period (frequent infections, meningitis) placed to incubator for 4 months. Diagnosed with cerebral palsy, diparetic from (tiptoe walking, introduced physiotherapy by Vojta) associated strabismus (for correction an occluder for dominant eye recommended). Suspect extensive hearing error (she refused a hearing aid) which resulted in inadequate comprehension the speech followed by delay in speech development. S. communicated with screaming, reluctant to express in another way, e. g. signs commonly used by her family. I case the people around did not understand or did not met expressed requirement, dissatisfaction was again expressed with anger, reluctance, scream. She behaved socially similarly to individuals with autism spectrum disorder. Internal and external irritability and low capability of concentration associated with hyperactivity. From infancy she displayed continuous motoric restlessness. S. is very smart and curious. Due to these socially and educationally hardly suggestible expressions a suspect for associated light mental retardation of S. was expressed. Motorics was characterised as awkward. Graphomotorics inaccurate, content and formally under average. Hygiene habits observed, without assistance. Present very low ability to focus, impatience, impulsivity, expressions of motoric restlessness, awkwardness, and unwillingness to communicate largely preclude any education (testimony of mother and school teacher from the preparatory grade period in special kindergarten). Physiotherapy uses practices by Vojta, speech therapy, reflex therapy, basal and neurodevelopmental stimulation, craniosacral therapy etc. Following special kindergarten she attended 1. grade of preparatory level in special elementary school. Nowadays she attends 1st class of elementary school for hearing impaired.

Family history: S. lives in complete family with older brother (10 years old) who is her model. The brother was hyperactive in preschool age, approximately at 7 years of age hyperactivity ceased inadvertently. Both parents shared care of S., mother more active.

Introduced therapy NFB. Main objective of training was total satisfaction mainly of regulation of hyperactivity, impulsive behavioural expressions, communication development, improve the movement coordination. The role of the therapist was accelerating the brain activity to necessary frequencies. Training protocol of general stabilisation set to inhibit slow delta and gradual increasing electric brain activities to faster the delta, theta, prealpha, alpha and finally SMR.

Summary: S. participated in 180 sessions during 2 years (from 6. to 8. year of age). S. uses hearing aid which she refused and tore down before. She communicates with narrative speech (simple terms), added with signs. In according to mother she tries very much to communicate, properly articulate, what she cannot say there she uses signs. The concentration time considerably extended, hyperactivity decreased (constant running around the room at home and at school ceased) she watches fairytales in normal speed – before 32× accelerated. Mather claimed that S. could concentrate

on 1–2 word in reading on the beginning of school year, three lines of text at the end of semester, but reading speed did not increase. In NFB training she is able to concentrate during whole time, before it was a problem to endure in first 5min long round. Behaviour displayed sedation, minimal signs of impulsive reactions. First time in her life mother experienced the moments when S. played alone and whole hour, does not require continuous attention of her parents or brother, sleeps peacefully through the night. In motoric area both mother and school teacher observed slight improvement in movement coordination. She handles writing well, writes clearly, can write alone even first words from memory. In the baseline EEG was fundamental activity of delta high amplitude, i. e. immaturity of CNS for the child's developmental phase (after 6th year prealpha up alpha should be displayed). After 100th session and control EEF there was observed prealpha and alpha as basic brain activity, but with remnants of the delta and theta.

Conclusion

The article discusses EEG Biofeedback in individuals with multiple disability in Slovakia. We submitted partial results from research in the field. We believe the findings may become basis for both further research and application of neurotherapy.

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Internetové zdroje

Internet resources.

www.biofeedback.sk

www.newgenerationbiofeedback.eu

www.isnr.org

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