ANOREXIA:
ANORMAL PHOBIA OF NORMAL WEIGHT

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ABSTRACT

Anorexia nervosa is a disorder of feeding behavior associated with distortion of body image, mood disturbance and a wide variety of hormonal and metabolic abnormalities. It is supposed that the disease could be the consequence of a combination of cultural-social, psychological and biological factors.

Our study confirmed that anorexia mentalis is a serious, life threatening disorder which in our country appears earlier than it was expected and that is strongly related to environmental factors (family, school, fashion, society).

We showed that specific personality traits are characteristic for both, young patients and mothers. Sublimation of emotional stress by exceptional performances, accompanied by food restrictive consumption together with hypersensitivity, oppositional behavior and aggression are specific for this disorder. High levels of self-imposed standards increase the risk for psychological distress, especially for eating disorder symptomatology.

Both genders could be involved as patients. Boys must be especially followed for possible psychiatric manifestation.

We confirmed that the biofeedback as additional therapeutic modality is very useful.

Key words: anorexia, mental disorder, personality, biofeedback

INTRODUCTION

Anorexia nervosa together with bulimia are disorders of feeding behavior associated with distortion of body image, mood disturbance and a wide variety of hormonal and metabolic abnormalities. The real cause is not precise, but it is supposed that the disease could be the consequence of a combination of cultural-social, psychological and biological factors [1-6].

Recently, researchers have discovered biological evidence of a genetic linkage on chromosome 1 for the complex psychiatric disorder together with anorexia. The linkage refers to the greater-than-chance likelihood that two separate DNA sequences will be close to one another on the same chromosome, supplying biological evidence for a genetic trait, if seen among two or more family members. The findings do not mean that a gene for anorexia nervosa was located, but only the potential genetic similarities among the tested relatives of anorectic persons are confirmed [7-9].

Although anorexia was recognized even in Hippocrates' medicine, in the last decades there is an increasing number of children and adolescents who suffer from this devastating condition.

It is known that the control mechanisms for eating behavior in humans are very rigid, involving

hypothalamic area, amygdale and precentral gyros in the brain cortex. In addition, multiple neurochemical mechanisms (catecholamine, dopamine, 5-hydroxytryptamine, serotonin, fenfluramine) have a strong control over the feeding behavior [10].

Many psychological processes have influence on the regulation of the eating behavior. In this context, boredom, anxiety and depression, as well as different stress could be related to anorexia.

Classically, anorexia nervosa appears in the period of adolescence and young adulthood in women, occurring less frequently in males. The essential characteristics are: refusal to maintain minimum normal weight for age and height (below 15% than expected), increased fear (phobia) of gaining weight or becoming fat, distorted body image and amenorrhea. The absence of at least three consecutive menstrual cycles, low body temperature, bradycardia, edema and many other metabolic changes are very typical. The mortality is supposed to be 5-15% and depends on the severity of the disease [11, 12].

It is confirmed in many studies that eating disorders are serious psychiatric pathologies. As it was said previously, the main characteristic is a pathological concern with body shape and weight above all. It is a fact that little is known about the pathophysiological mechanisms. The basic knowledge of the neural basis of the behavior has advanced rapidly in recent years, and this knowledge has begun to yield a better understanding also for the other mental illnesses. The possibility that there is a dysfunction of the central nervous system in patients with anorexia has been explored in several ways, including studies of neuropsychological test performance [13].

It has been supposed that anorexia nervosa is the principal symptom of phobia of the normal adolescent weight following the growth changes of puberty. Earlier current psychosexual maturity in children (before 13-14 years) accompanied with fashion trends, provoke the phobia of weight gain.

There are no precise data for the incidence of anorexia nervosa in Macedonia, but in some statistical reports it is noted that 7.4% of all patients in Macedonia between 12 and 40 years of age manifested some "eating problems". The worsening of socioeconomic and political situation as an enormous provocation of the stress level, could be related to the increase of the incidence of anorexia in our country.

Adolescence is the main developmental factor that increase the risk of anorexia, females comprising over 90% of the patients. Environmental factors such as stress in school, families, competition with peers could be also contributive. Food consumption could be also related to the state of boredom, fatigue, or tension. In this context, three basic dimensions of emotional state (pleasure-displeasure, mental arousal, and dominance-submissiveness) are estimated as independent factors relevant to food intake.

The abundance of food in the developed counties provoked an epidemic of disorders connected to the food intake and obesity. On the other side, extreme concern about one's body image could result in anorexia nervosa. Prospective studies have suggested that the negative affect, negative body image, low self-esteem, obsessive-compulsive traits, perfectionism, poor interoceptive awareness, and externalizing symptoms may be associated with the development of problems with eating and weight.

METHODOLOGY AND SAMPLE

The article is devoted to some psychological traits and neurophysiological specifies of 50 anorectic girls, selected by chance of overall 150 treated at the University Pediatric Clinic in Skopje. The mean age of the patients was 13.15 years (SD ± 1.99) and the bodyweight below the 3th percentile. All of them have been with normal intellectual levels (IQ slightly over 100). We included in this study 10 boys with anorexia mentalis, aged 12,50 (SD ± 0.55) years, with the same somatic characteristics.

All the children were firstly examined clinically, and biochemical analyses additionally excluded organic etiology. The patients who were in dangerous health state were firstly stabilized, and after this period were psychologically and neurophysiologically evaluated. The diagnosis was made according to two statistic manuals: DMS-IV-R (American Psychiatric Association: Diagnostic and statistical manual of mental disorders DSM-IV, 4th Ed, 1994) and ICD-10 (1993) [14].

The psychological assessment comprised interviews with mothers and patients, Eysenck Personality Questionnaire (EPQ) [15], Emotional Profile Index (PIE) [16] and Minnesota Multiphasic Personality Inventory (MMPI-201) [17] for adolescents above 14 years, as well as for mothers of the patients.

The EPQ was chosen to examine the four classical characteristics of the personality: N, level of emotional stability/neuroticism; E, dimension of extraversion/introversion; P, dimension of psy-

chotic behavior; and L, degree of dissimulation or social adaptability. Our previous experience with this instrument confirmed the validity, reliability and distinction of the obtained results, especially in the preadolescence and adolescence [18, 19, 20].

The PIE was used for the evaluation of the correlation of emotional structure of the patients and their personal characteristics. The basic theoretical concept of the test is that personality traits are the results of primary emotions and emotional states. The emotional profile, indicating the main conflicting area of the person, is defined through eight dimensions (related to eight respective emotional states): incorporation (acceptance), non-control (impulsiveness), self-protection (fear), deprivation (sadness), opposition (refusal), exploration (self-control), aggression (destruction) and reproduction (vivacity). Bias represents the scale for assessment of socially favorable answers (i.e. lying scale). The results obtained with this instrument could be compared with Mahrabian's basic dimensions of emotion states (arousal, pleasure, dominance) [21].

The MMPI-201 was chosen for evaluating the main dimensions of the personality such as: hypochondria (Hs), depression (D), hysteria (Hy), psychopathic traits (Pd), paranoid thoughts (Pa), psychastenia (Pt), schizoid traits (Sc) and hypomania (Ma). The control scales (k, l and f) give information about sincerity/lying of the client.

The raw scores on the scales are transformed into a standardized metric known as T-scores (Mean or Average equals 50, Standard Deviation equals 10), making the interpretation easier for clinicians. Before the analysis of the clinical scales, some criteria should be satisfied: l and k scales must be with the score ≤ 70 and f scale ≤ 80. A significant advantage of the MMPI over other self-report and observer rating scales is that it provides valid and reliable estimates of response bias.

Finally, recording of QEEG together with ERP's is done [22]. EEG was recorded with Quantitative EEG equipment (Mitsar, Ltd.) amplifier[from 19 electrodes, referenced to linked ears (on the International 10-20 system) with 250 Hz sampling rate in 0.3-70 Hz frequency range in the following conditions: 1) Eyes opened (EO) - 5 minutes, 2) Eyes closed (EC) - 5 minutes, 3) Visual continuous performance task (VCPT) - 20 minutes, and 4) Auditory continuous performance task (ACPT) - 20 minutes.

The 19 electrode positions were allocated to three sagittal regions: Frontal – Fp1, Fp2, F3, Fz, F4, F7 and F8; Central – T3, T4, C3, Cz and C4; and Posterior – T5, T6, P3, Pz, P4, O1 and O2.

In this paper we do not present brain maps and spectra power, but only our calculated parameter named brain-rate which could be related to the state of underweight and metabolic changes in these patients.

Brain rate is a parameter correlated to the brain electric and metabolic activity [23, 24]. In particular, brain rate – in further text- fb , can serve as a preliminary diagnostic indicator of the general mental activation (i.e. consciousness level, arousal), in addition to the heart rate, blood pressure or temperature as standard indicators of general bodily activation.

The brain rate (Pop-Jordanova N, Pop-Jordanov J, 2005) can be calculated with the following formula:

$$f_b = \sum_i f_i P_i = \sum_i f_i \frac{V_i}{V} \quad V = \sum_i V_i$$

where the index i denotes the frequency band (for delta i = 1, for theta i = 2, etc.) and Vi is the corresponding mean amplitude of the electric potential or power.

The obtained results from the QEEG were exported to the brain rate software and then calculated for each region separately. The QEEG spectra power data and the data for the brain rate were analyzed using the Statistica software (version 7.0). A series of repeated measures analysis of variance - Factorial ANOVA was performed using the factors: sagittal topography (frontal, central and posterior region), measurement condition (EO, EC, VCPT and ACPT) and group (ill patients and controls) for spectra power values. Then, post hoc Bonferroni test was performed to explain significant interactions.

The therapeutic approach applied to the anorectic patients included a strong nutritional regime (parenteral nutrition if needed), electrolyte and water balance, additional supply of vitamins and minerals, controlled physical activity, behavior-supportive therapy and biofeedback. All children are initially assessed for stress level with electrodermal resistance (EDR). The sessions for relaxation training included additional animated sequences as part of a virtual reality multimedia system adapted for eating behavior. Finally, neurofeedback was applied for control of the arousal [25, 26, 27].

RESULTS

The evaluated group comprises 50 girls with anorexia. Mean age of patients was 13.15 years (SD ± 1.99) and bodyweight below the 3th per-

centile. We included in this study 10 boys with anorexia mentalis, aged 12.50 (SD ± 0.55) years, with the same somatic characteristics. All patients had normal intellectual levels (IQ slightly over 100) tested with Kohs's cube test.

The obtained results for EPQ in girls are presented in Fig. 1. We compared four main personality characteristics in girls aged 11-13 years with those aged 14-16 years. The younger group showed higher neurotic tendencies but a smaller psychopathological traits. The older group showed higher lye tendencies and higher psychopathological traits, which seem us logical. The level of extraversion is similar in both groups.

For boys, the mean age was 12.50 (SD ± 0.55) years and the obtained results for EPQ are presented in Figure 2. It is obvious that the psychopathological traits are dominant in this profile, but also neurotic tendencies are accentuated.

The results obtained for PIE are presented in Figures 3. As it can be seen, girls showed accentuated scores for non-control, opposition and aggression which corresponds to the clinical characteristics as well. For boys, the results obtained
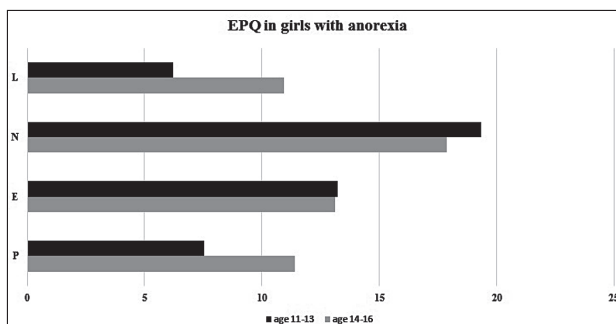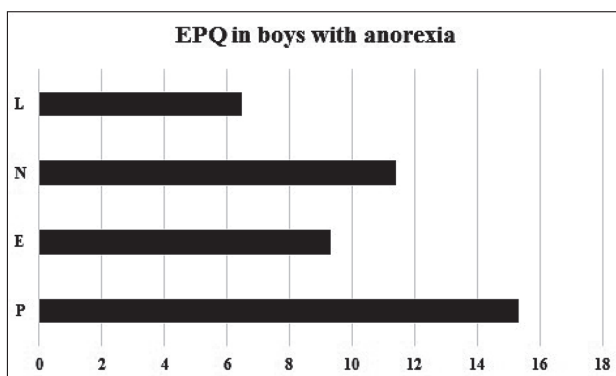

Figure 1. Results obtained for EPQ in anorectic girls
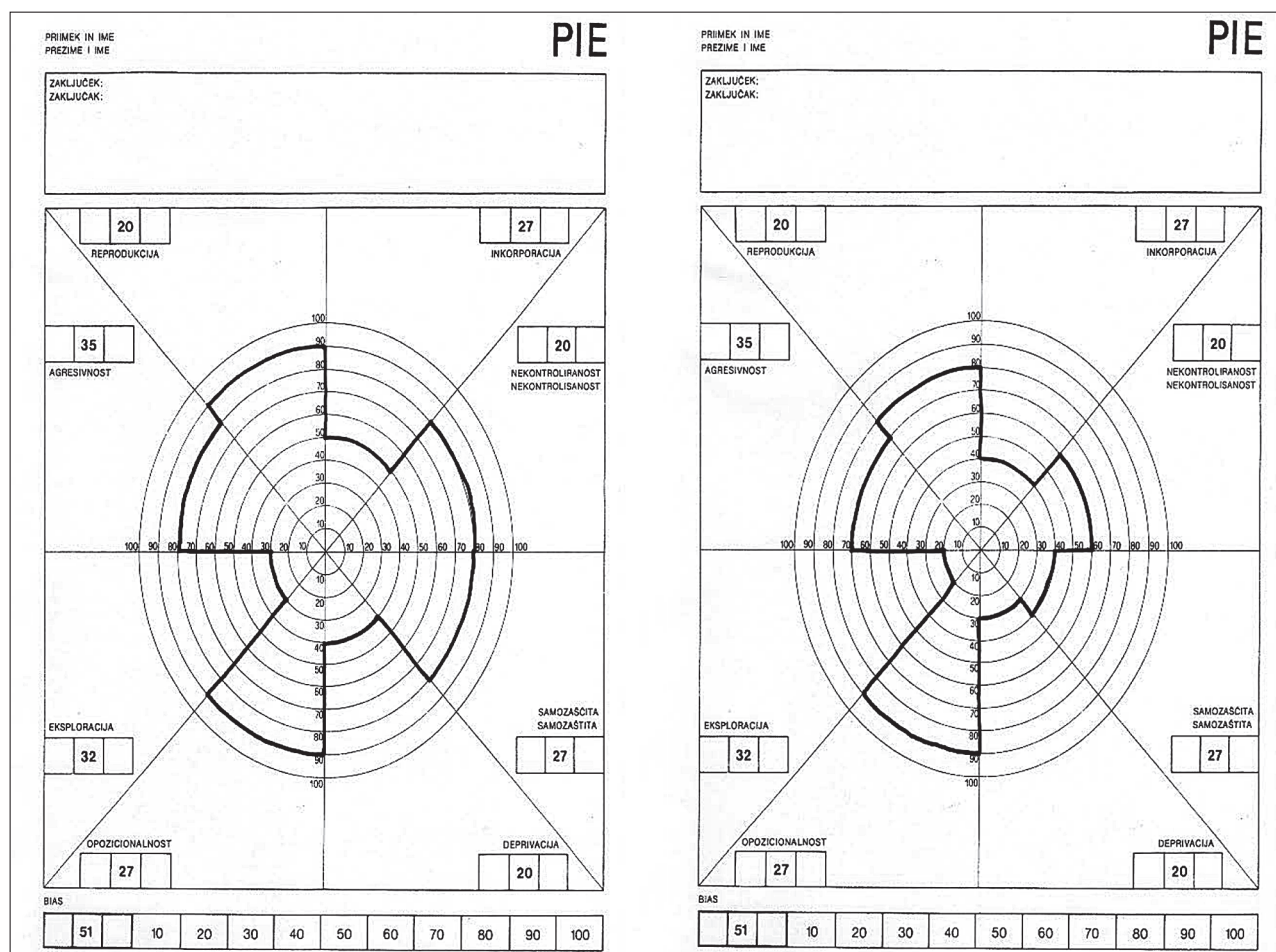

Figure 2. EPQ results in anorectic boys

Figure 3. Results obtained for PIE in a) anorectic girls and b) anorectic boys

for PIE showed high aggressiveness and repro-duction, but also oppositional behavior.

As it was mention in the methodology, the older girls and boys were examined with MMPI-201 for personality characteristics. The results for both groups are displayed in Figure 4.

Mothers are the main personalities influenc-ing the child's growth and development. It is very important to evaluate the relation between mothers and children especially in the adolescent period. For all patients we evaluated the MMPI-201 pro-files of their mothers. The obtained results are shown in Figure 5.
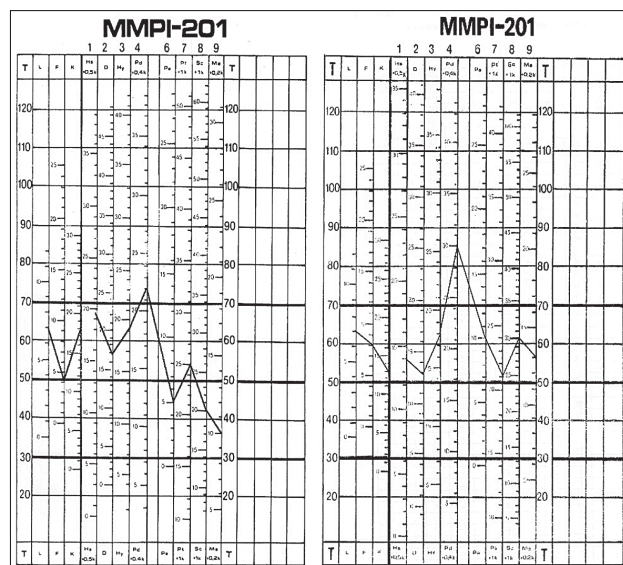
Figure 4. MMPI-201 for a) anorectic girls and b) anorectic boys (accentuated Pd score in both) confirming emotional instability

The profile for the mothers of younger pa-tients is related to hypersensitive and depressive tendencies, while for older patients hypersensitiv-ity is accompanied with some psychopathic traits.

The QEEG spectra generally showed beta brain activity in some regions related to anxiety level. Supposing that the level of anxiety is high
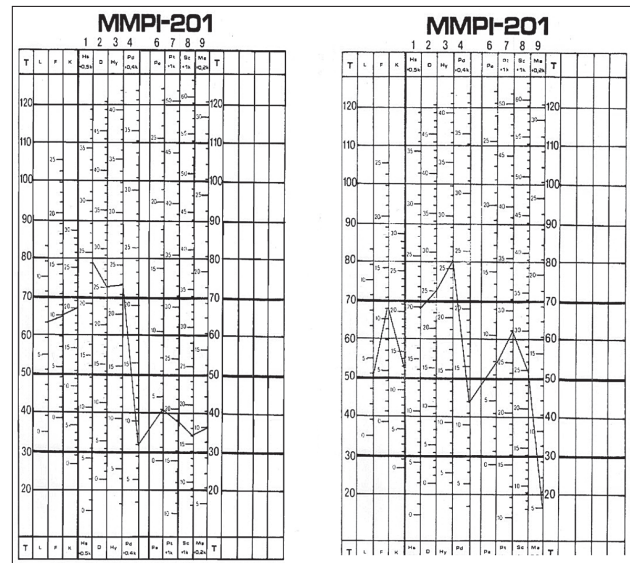
Figure 5. MMPI-201 shows profile of mothers of a) smaller patients (Hs- D- Hy) and b) older patients (Hy-Pt picks)

in all anorectic patients, we calculated the brain-rate parameter. Brain-rate is good indicator for mental arousal, as well as for metabolic activity in the brain. The Figure 6 shows results of brain-rate in different topographies (frontal, central and posterior) in sagittal and lateral positions.
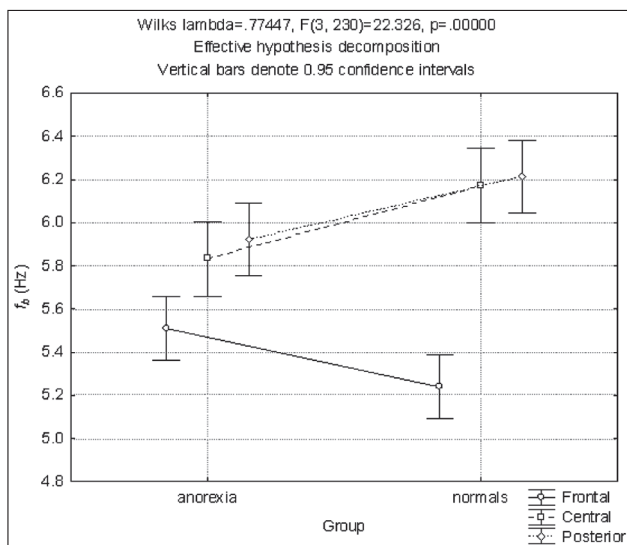
According to the sagittal topography the max-imal values of fb parameter were registered in the central and posterior region for the control group $F_{(3,230)} = 22.33$; $p=0.00000$. Using ANOVA/MANOVA test we got a positive correlation of the fb parameter and the group factor.

According to the lateral topography ANOVA/MANOVA test showed positive correlation of fb parameter values with factor group with signifi-cantly higher values in both lateral comparing with the midline region.

Finally, for summarizing the significance of the differences for every region separately ac-cording to the different condition we use post hoc Bonferroni test:
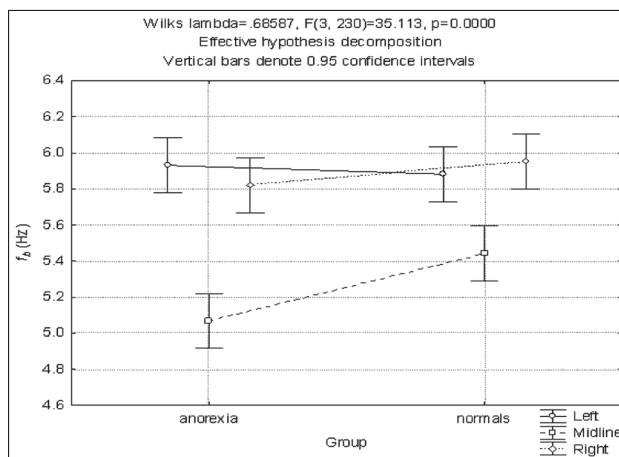
Table1. Summary of the significant post-hoc Bonferroni P-values for brain rate difference between groups, regions and conditions (group of anorectic patients and control group of healthy children)

		Frontal f_b	Central f_b	Posterior f_b	Lateral Left f_b	Midline f_b	Lateral Right f_b
Group effect	Normal's vs. Anorectic	0.010779	0.006997	0.017625		0.000664	
Condition effects	EC vs. EO		0.021364	0.000000	0.000068	0.000000	0.000209
	EC vs. VCPT		0.036642	0.000000	0.009815	0.000000	0.023117
	EC vs. ACPT		0.007795	0.000000	0.000016	0.000000	0.000594
	EO vs. VCPT	0.004733					
	EO vs. ACPT						
	VCPT vs. ACPT						

Figure 6. Values of brain rate fb parameter according to the sagittal topography in a group of anorectic patients and control group of healthy children (the results are presented as Mean values ± SD F=22.33; p<0.001).

Figure 7. Values of brain rate fb parameter according to the lateral topography in a group of anorectic patients and the control group of healthy children (the results are presented as Mean values± SD F=35.11; p<0.001)

Finally, we used LORETA (Low resolution tomography) and s-LORETA for obtaining 3D distribution of the neuronal activity in anorexia mentalis. The Figure 8 shows LORETA and s-LORETA results for 13 years anorectic girl. It is clear that there is pathological activity in Brodmann 7 area in superior parietal lobule (left) and parietal lobe (right).

Non-invasive scalp measurements of electric potential differences (EEG) [as well as magnetic field measurements (MEG)] can be used for estimating the electric neuronal activity distribution on the cortex. The methods proposed here are LORETA (Pascual-Marqui 1999), and standardized LORETA (sLORETA) (RD Pascual-Marqui 2007).

The time series of the cortical electric neuronal activity estimated with LORETA can be used
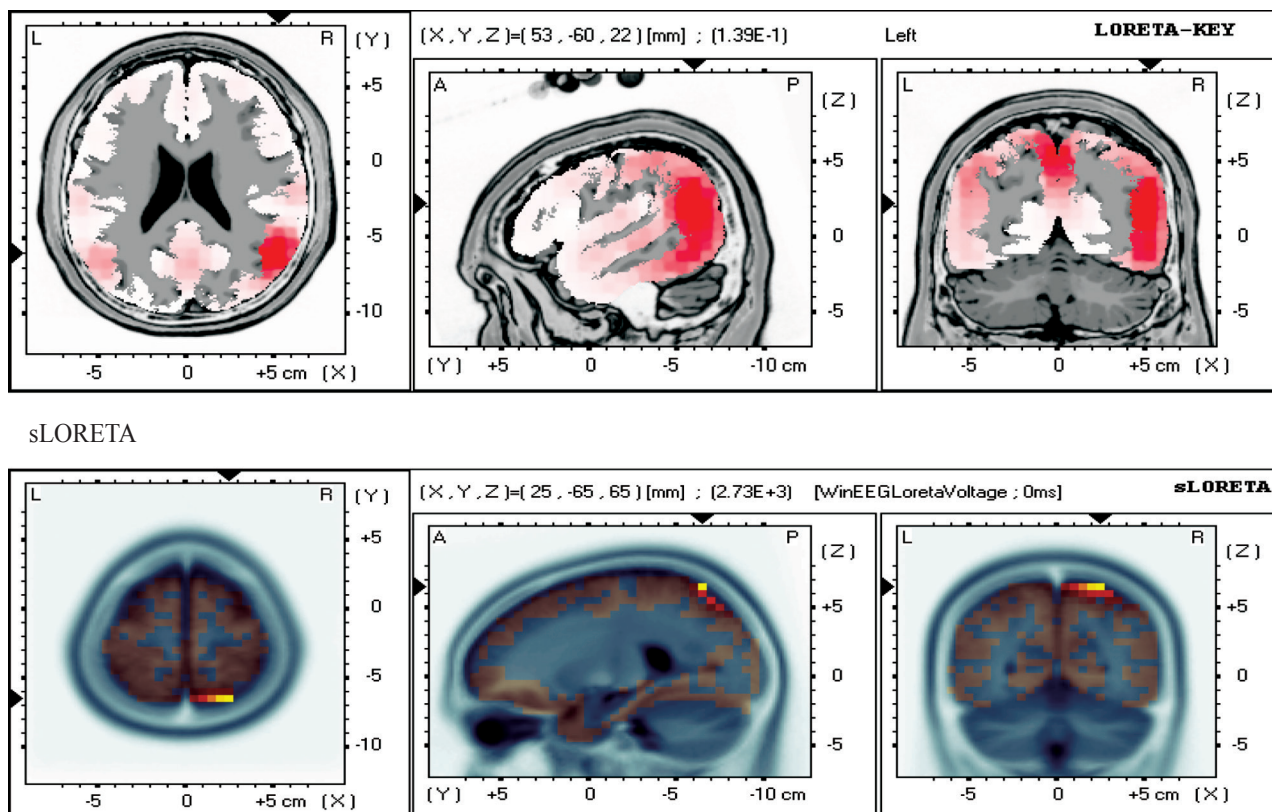
Figure 8. LORETA and s-LORETA in 13 years girl with anorexia

for estimating the cortical connectivity, based on the following informal definition: "Two places are functionally connected if their activity time series are similar".

The functional connectivity is of central importance in understanding the brain function. For this purpose, multiple time series of electric cortical activity can be used for assessing the properties of a network: strength, directionality, and spectral characteristics (i.e. which oscillations are preferentially transmitted) of the connections.

The Brodmann area 7 is a part of parietal cortex, named as precuneus. This region is involved in episodic memory and visual-spatial processing important for the perception of own body. It means that in anorectic patients there is cortical dysfunction and deficit in somatic-sensory integration as a neurological basis.

DISCUSSION

Classically, anorexia nervosa is a disorder which appears in young adult females. Our experience, as well as in this study, has shown that the onset of anorexia tends to be shifted toward the preadolescent period in both, girls and boys. The earlier start of puberty together with the stress related conditions of living could be related to this early manifestation of diseases. Our youngest patient with anorexia had only seven years.

Concerning the personality, in our study we found that concerning the girls extroversion, increased anxiety, emotional instability and psychopathologic tendencies that increase with the age are the main characteristics. For boys, the main characteristics are the accentuated psychopathological traits together with the emotional instability. In emotional profile, girls showed accentuated scores for non-control, opposition and aggression which corresponds to the clinical characteristics as well. For boys, the results obtained for PIE showed high aggressiveness and oppositional behavior. The follow up for both groups of patients showed that practically all girls overcome the disease in a period of one year. In opposite, majority of boys manifested some psychiatric disorder in a few months after the manifestation of anorexia. This results are very alarming and must be taken into a care while boys manifest anorectic symptoms.

Mothers with hypersensitive characteristics, rigid moral norms, frequently combined with depressive and psychopathological traits are shown to be the potential risk for behavior of teenagers.

Finally, we obtained that opposite to our expectations, QEEG and brain-rate parameters showed hypo-arousal in anorectic patients which can be the consequence of the diminished metabolic activity in the brain. Our findings are different for other studies for EEG in anorectic girls which mainly confirmed the dominance of beta brain waves and hyperarousal due to anxiety [28- 31].

Anorexia mentalis could be related to coping the style of young persons. Living in an environment with high stress, overwhelmed by fashion presented on TV, films or magazines, young people with obsessive, perfectionistic and above intelligent abilities chose anorexia as a wrong way to solve their actual problems.

As the novel approach in the therapy we used biofeedback modalities together with the classical nutritive, cognitive behavioral and supportive therapies. Biofeedback is based on operant conditioning toward self-control. We have very positive experience with electrodermal biofeedback in many stress-related disorders such as headaches, somatizations, ticks etc. [27] Electrodermal biofeedback in anorexic patients is used to obtain relaxation and for diminish stress and anxiety. Neurofeedback protocols used as a treatment of anorexia are personalized, depending on each individual QEEG pattern. Very positive results confirmed through statistics were obtained for both forms of biofeedback.

CONCLUSIONS

Our study confirmed that anorexia mentalis is a serious, life threatening disorder which appears earlier than it was expected in the classical literature and that is strongly related to the environmental factors (family, school, fashion, and society).

We showed that specific personality traits are characteristic for both, young patients and mothers. Sublimation of the emotional stress by exceptional performances, accompanied by food restrictive consumption together with hypersensitivity, oppositional behavior and aggression are specific for this disorder. High levels of self-imposed standards increase the risk for psychological distress, especially for eating disorder symptomatology.

Both genders could be involved as patients. Boys must be especially followed for possible psychiatric manifestation.

We confirmed that biofeedback as additional therapeutic modality is very useful.

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АНОРЕКСИЈА: АБНОРМАЛНА ФОБИЈА НА НОРМАЛНАТА ТЕЖИНА

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Резиме

Менталната анорексија претставува специфично поведение поврзано за исхраната асоцирано со растроена слика на сопственото тело, нарушување на расположението и широка палета на хормонски и метаболички абнормалности. Се претпоставува дека болеста може да биде последица од комбинација на културно-социјални, психолошки и биолошки фактори.

Нашата студија потврди дека менталната анорексија е сериозна, живото загрозувачка болест, која во нашата земја се јавува порано отколку што се претпоставува и дека е силно поврзана со околински фактори (семејство, школо, мода, општество).

Покажавме дека за двете групи (деца и нивните мајки) се специфични некои посебни карактеристики на личност. Сублимација на емоционалниот стрес преку извонредни перформанси, здружени со рестриктивна консумација на храна, заедно со хиперсензитивност, опозиционо однесување и агресија се специфични за ова заболување. Високите нивоа на само наметнати стандарди го зголемуваат ризикот за психолошки дистрес, особено изразен во симптоматологијата на болестите на исхраната. Обата пола можат да бидат инволвирани. Момчињата мора специјално да се следат поради опасноста од ментални растројства.

Потврдивме дека како дополнение на терапевтските приоди, нашите искуства со биофидбек методологијата се многу позитивни.

Клучни зборови: анорексија, ментално растројство, личност, биофидбек