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Identity Integration Disorder as a Promising Model for the Study from the Standpoint of Evolutionary Diatropics

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Abstract: Diatropics is an evolutionary theory of diversity and the mechanisms of its formation. Identity integration disorder (IID) is a specific mixed form of psychopathological diathesis, characterized by the presence in the personality structure of a combination of symptoms of the three main circles of mental disorders: schizophrenic, epileptic, affective. Our study evaluated the peculiarities of the neurophysiological indices of the brain of persons with IID as consolidating with respect to the main forms of mental disorders, to substantiate the possibility of studying this phenomenon as a diatropic model of mental pathology. A total of 76 subjects with IID and 20 mentally healthy subjects were selected. For neurophysiological examination, cross-correlation analysis of electroencephalography respondents was used. The changes in the connections between the different brain regions of individuals with IID can be described as indicating two main features: 1) a decrease in the degree of interaction between centrally localized structures - the temporal, and upper parietal; 2) an increase in the degree of interaction between the integration of the frontal and occipital regions. The presence of signs of mental disorders in the human population is necessary in order to form a special group of highly intelligent, creatively gifted.

Keywords: identity integration disorder; diatropics; psychopathological diathesis; cross-correlation analysis of electroencephalography (EEG)

1. Introduction

The concept of identity integration disorder (IID) received full coverage only after the release of the works of Murray, in which, within the framework of his teaching on infantile forms of activity, a separate “urethral complex” is distinguished, which received the additional name “Icarus complex” and includes the following signs: fire cathexis, enuresis, striving for immortality, pronounced narcissism and high ambitions with low tolerance to frustration (Murray, 1955). For several years, we systematically investigated this mental phenomenon (under the general name “Icarus syndrome” (Korolenko, Dmitrieva & Spiks, 2012)), using various methods in the structure of an interdisciplinary approach to its study, and as a result, we came to the conclusion that there is a universal scheme basis and called the "principle of chimera". This design indicates the need to combine the characteristics of the three main circles of mental pathology in the composition of this

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disorder: schizophrenic, epileptic, affective, which was originally demonstrated by us on the basis of clinical data and the results of the pathopsychological experiment (Badalov et al., 2018). Nevertheless, we consider it necessary to extend the use of the claimed concept, since the very concept of signs relating to the painful changes in the mental sphere of an individual needs to be extended beyond the abnormal: their frequency in various combinations and relationships is too great, including among those recognized as mentally healthy individuals so that their presence in the human population can be easily eliminated (Badalov et al., 2020; Badalov & Brovkina, 2017a; Badalov & Brovkina, 2017b). In addition, it is essential to find a way to justify the presence of the described features from the point of view of their morphofunctional basis, since only a systematic interdisciplinary approach allows you to look at mental disorders from a different angle and provides new opportunities for understanding their nature. The most promising theoretical basis for this kind of research is, in our opinion, the theory of evolutionary diatropics, originally created in the eighties of the last century as part of the theory of nomogenesis, and later found a possibility of universal application. Diatropics is the science of diversity and its laws, which rather answers the question "how" this or that change is carried out, leading to the appearance of a quantitatively or qualitatively new sign, rather than "why" it happens. In the application of diatropics to the theory of evolution, it is postulated that various signs can not only be useful, harmful or indifferent to the survival of an individual, but also that this diversity itself is genetically programmed, and is not solely a consequence of random mutations fixed or eliminated by natural selection (Chaikovskiy, 1990).

From this point of view, IID is an exceptionally convenient and promising model of the stated research, due to the fact that, as mentioned above, it carries signs of all major circles of mental disorders in approximately equal proportions. It is necessary to add that the essential feature of persons with IID is that they have a higher than average level of intellectual development, which allowed us to come to a paradoxical, at first glance, conclusion: the structure of this disorder should include an individual's intellectual profile as an additional parameter. Here we should note that the very concept of "intelligence" is interpreted by us from a system-integrative point of view much broader than just the ability to effectively solve the problems declared in common tests of the intellectual level as reference ones. Intellect should be considered as a synergistic complex that has several measurement parameters: volume, specific complexity and system formation rate, respectively, received the names of versativity, ingenitivity and rapidity, or breadth, depth and quickness of mind (Ryzhov, 2010). That is, the definition of intelligence as the degree of brain efficiency of an individual and as a complex composite system that determines the development of a population, where it is not the individual himself that is important, but the product of activity created by him are not identical to each other. It is the latter that most clearly characterizes the system of cognition and creativity that is obtained from the combination of characteristics encoded by the described parameters, which is necessary from the point of view of the evolution of populations. According to the results of the study of the features of the cognitive functions of persons with IID (Badalov et al., 2018), we can rightfully say that they have all the above-listed properties: versativity, ingenitivity and rapidity. Moreover, these properties, apparently, are formed just as a result of a combination of the high efficiency of the brain and potentially pathological signs of schizoid, epileptoid and affective character. The degree of brain efficiency is also determined by language capabilities and language and speech activities. The interrelation depends on the evolutionary history of human species, along with that, the co-evolution of human language and the human brain (as the material substratum of language and speech functions). Also, the development of intellectual and cognitive functions depends on linguistic development (the origin and emergence of human language from a diachronic perspective). However, in order to obtain confirmation of the presented concept, we need to fix the presence of the described signs not only from the phenomenological, as it was done previously but also from the neurophysiological position, as this will allow us to exclude the constructions that are part of its structure. Therefore, we used the cross-correlation analysis of the EEG, which makes it possible, first of all, to determine the connections between different sections of the brain, that is, to trace the work of the latter in dynamics

An important part of our research was also the analysis of mythological and archetypical structures reflecting the functioning of certain types of individuals, including those who demonstrate Icarus syndrome. On the whole, there are few such studies: both abroad and, especially, in post-Soviet countries, they are rare (Arpentieva, 2018; Gorelova & Arpentieva, 2018; Green et al., 2019; Kassymova et al., 2020; Kassymova et al., 2019; Kendal et al., 2018; McAdams & Reischer, 2019; Roubekas & Ryba, 2020; Uchiyama & Muthukrishna, 2019). It should be mentioned some linguistic-oriented studies, particularly the work of Anisimov (Anisimov, 1991) and the works of Makovsky (Makovsky, 2012; Makovsky, 2013; Makovsky, 2014a; Makovsky, 2014b; Makovsky, 2018) Anisimov's work deals with the algorithmic analysis of myth structure, mythological thinking and archetypes. Series of Makovsky's works have as main subjects the linguistic representation of archetypes in Indo-European languages and mythologies and semasiological analysis of them. "Rehabilitation" of research on archetypes is going on contradictory and is still far from any full-fledged and harmonious fusion with the problems of psychophysiological research (Becker & Neuberg, 2019a; Becker & Neuberg, 2019b; Beebe, 2016; Boschetti et al., 2016; Chan, 2017; Cona et al., 2019; Fox et al., 2017; Maltsev, 2019).

2. Materials and Methods

A total of 76 subjects with IID (main group) and 20 mentally healthy subjects (control group) were selected. The cross-correlation analysis of the EEG was carried out using the software of the Mitsar EEG Studio hardware complex, which, using the graph projection theory method in a very visual form, reflects the dynamics of moving the foci of maximum

activity and the conjugate inhibition of the areas of the left and right hemispheres of the brain. In the language of graph theory of this kind, regions are designated, respectively, as centers of the “source” and “drain”. The degree of similarity or connection of two EEG in cross-correlation analysis is determined by the magnitude of the cross-correlation coefficient (CCC), which can take values from -1 to +1. The value of the CCC can be judged on the strength of the connection of two processes: when the value of the CCC is from -1 to 0.3, the link is weak, from 0.3 to 0.5 is the average bond strength, and from 0.5 to 1.0, the link is tight (Rusinov, Grindel & Boldyreva, 1988). The data on the nature of relations in the main (MG) and control (CG) groups are summarized in table 1.

Statistical processing of the results was performed using the SPSS 16.0 for Windows application package. The critical value for statistical significance when testing statistical hypotheses in this study are taken to be 0.05. The verification of quantitative data for compliance with the normal distribution law was performed using the Shapiro-Wilk. The description of normally distributed quantitative features is presented in the form of mean and standard deviation. The description of quantitative traits, the distribution of which does not correspond to the normal distribution, is given in the form of a median and interquartile range. Independent samples were compared using the Student's t-test. Comparison of quantitative data that do not correspond to the normal distribution law was carried out using the Mann – Whitney test.

3. Results

Based on the theory of dynamic localization of higher mental functions, Luria (Luria, 1973; Luria, 2017; Muthukrishna & Henrich, 2016; Muthukrishna et al., 2018; Oatley, 2019), to study the functioning of connections in the cerebral cortex of the subjects, we chose the so-called associative areas: pre-frontal and temporal-parietal-occipital. In addition, we investigated the relationship between the same areas of the hemispheres of the brain of persons with IID, due to the fact that the dynamics of their work also underlies the emergence of mental disorders that can be attributed to the above main psychopathological circles. All the data obtained are summarized in table 1.

Table 1: Indicators of the cross-correlation coefficient (CCC) and the statistical significance of differences (P-value) in the main group (MG) and control group (CG) on leads (L).

L	CCC MG	CCCCG	P-value	L	CCC MG	CCC CG	P-value
F3-FP1	0,910 (0,835-0,951)	0,918 (0,865-0,937)	0,912	F3-P4	0,440 (0,336-0,583)	0,587 (0,479-0,725)	0,002
F4-FP1	0,741±0,152	0,708±0,120	0,148	F4-P4	0,464 (0,345-0,595)	0,754 (0,603-0,851)	<0,001
F7-FP1	0,724±0,149	0,830±0,111	<0,001	F7-P4	0,408 (0,305-0,569)	0,454 (0,334-0,589)	0,388
F8-FP1	0,566±0,174	0,662±0,156	0,001	F8-P4	0,456±0,153	0,612±0,161	<0,001
C3-FP1	0,506±0,166	0,743±0,134	<0,001	C3-P4	0,479±0,148	0,686±0,139	<0,001
C4-FP1	0,487±0,162	0,599±0,138	<0,001	C4-P4	0,614±0,177	0,816±0,117	<0,001
T3-FP1	0,358 (0,297-0,470)	0,621 (0,519-0,739)	<0,001	T3-P4	0,394 (0,322-0,527)	0,679 (0,452-0,767)	<0,001
T4-FP1	0,349±0,112	0,511±0,156	<0,001	T4-P4	0,657 (0,473-0,757)	0,787 (0,627-0,842)	<0,001
T5-FP1	0,383±0,158	0,400±0,127	0,484	T5-P4	0,424±0,120	0,480±0,158	0,018
T6-FP1	0,420±0,166	0,378±0,091	0,042	T6-P4	0,536±0,198	0,637±0,139	<0,001
P3-FP1	0,477±0,180	0,549±0,184	0,014	O1-P4	0,580±0,163	0,539±0,196	0,203
P4-FP1	0,484±0,204	0,471±0,125	0,598	O2-P4	0,784 (0,661-0,882)	0,678 (0,549-0,809)	0,007
O1-FP1	0,503±0,183	0,397±0,115	<0,001	F3-T5	0,387±0,145	0,416±0,120	0,194
O2-FP1	0,520±0,184	0,413±0,127	<0,001	F4-T5	0,389 (0,279-0,572)	0,381 (0,311-0,420)	0,723
F3-FP2	0,733±0,147	0,729±0,116	0,879	F7-T5	0,367±0,116	0,402±0,131	0,081
F4-FP2	0,895 (0,814-0,946)	0,893 (0,853-0,944)	0,820	F8-T5	0,401±0,175	0,405±0,103	0,864
F7-FP2	0,541±0,186	0,658±0,162	<0,001	C3-T5	0,416±0,155	0,499±0,132	0,001
F8-FP2	0,759±0,125	0,844±0,088	<0,001	C4-T5	0,374 (0,271-0,517)	0,364 (0,309-0,499)	0,555
C3-FP2	0,443±0,147	0,616±0,114	<0,001	T3-T5	0,639±0,154	0,650±0,171	0,668
C4-FP2	0,531±0,180	0,721±0,128	<0,001	T4-T5	0,334±0,115	0,418±0,142	<0,001
T3-FP2	0,374±0,105	0,528±0,159	<0,001	T6-T5	0,372±0,125	0,429±0,142	0,008
T4-FP2	0,387±0,136	0,578±0,162	<0,001	O1-T5	0,664±0,161	0,645±0,182	0,491
T5-FP2	0,452±0,135	0,386±0,125	0,002	O2-T5	0,473±0,133	0,489±0,184	0,569
T6-FP2	0,404±0,153	0,446±0,144	0,081	F3-T6	0,416±0,158	0,404±0,110	0,551
P3-FP2	0,485±0,188	0,446±0,140	0,157	F4-T6	0,369 (0,276-0,511)	0,388 (0,355-0,531)	0,019
P4-FP2	0,482±0,184	0,533±0,175	0,086	F7-T6	0,384±0,164	0,393±0,093	0,656

Table 2: Indicators of the cross-correlation coefficient (CCC) and the statistical significance of differences (P-value) in the main group (MG) and control group (CG) on leads (L).

L	CCC MG	CCCCG	P-value	L	CCC MG	CCC CG	P-value
C3-P3	0,599±0,185	0,813±0,091	<0,001	O2-T6	0,579±0,170	0,628±0,182	0,088
C4-P3	0,470±0,123	0,610±0,147	<0,001	FP1-FP2	0,821 (0,718-0,891)	0,799 (0,646-0,844)	0,040
T3-P3	0,601±0,175	0,740±0,115	<0,001	F7-F8	0,469±0,171	0,588±0,173	<0,001
T4-P3	0,406±0,119	0,533±0,188	<0,001	F3-F4	0,831 (0,741-0,891)	0,768 (0,638-0,834)	0,014
P4-P3	0,660±0,145	0,746±0,131	<0,001	T3-T4	0,346 (0,289-0,453)	0,625 (0,408-0,679)	<0,001
T5-P3	0,621±0,171	0,642±0,125	0,363	C3-C4	0,585±0,177	0,738±0,089	<0,001
T6-P3	0,384±0,133	0,475±0,173	0,001	T5-T6	0,359 (0,289-0,449)	0,455 (0,388-0,567)	<0,001
O1-P3	0,756±0,153	0,626±0,193	<0,001	P3-P4	0,675 (0,561-0,763)	0,838 (0,719-0,910)	<0,001
O2-P3	0,580±0,149	0,495±0,170	0,001	O1-O2	0,791 (0,702-0,868)	0,885 (0,721-0,938)	0,01
O1-FP2	0,559 (0,352-0,673)	0,356 (0,305-0,499)	<0,001	F8-T6	0,402±0,138	0,487±0,129	<0,001
O2-FP2	0,508±0,179	0,432±0,137	0,003	C3-T6	0,366 (0,255-0,482)	0,373 (0,313-0,501)	0,268
F3-P3	0,470±0,166	0,662±0,179	<0,001	C4-T6	0,397±0,147	0,526±0,174	<0,001
F4-P3	0,445 (0,324-0,576)	0,564 (0,410-0,669)	0,003	T3-T6	0,327±0,121	0,399±0,136	0,001
F7-P3	0,456±0,154	0,525±0,182	0,013	T4-T6	0,615±0,171	0,706±0,133	<0,001
F8-P3	0,426 (0,308-0,610)	0,479 (0,337-0,619)	0,382	O1-T6	0,425±0,148	0,486±0,182	0,022

4. Discussion

According to the results of studies on the links between different areas of the cerebral cortex of patients with schizophrenia, epilepsy and endogenous depression, each of these diseases is characterized by a specific pattern of synchronicity of biopotentials. In patients with schizophrenia, the strength of the interaction between the hemispheres and between the frontal and parietal regions of the right hemisphere is reduced (Merrin et al., 1989; Norman et al., 1997, Aksarina et al., 2019). They also had reduced integration between the frontal and temporal regions, mostly on the left. At the same time, as the disease progressed, the hemispheres became increasingly disconnected, and the synchronism of the occipital parts gradually increased (Strelets et al., 2001). In epilepsy, the level of interhemispheric synchronization also decreases in comparison with the norm, however, the level of pole-pole (frontal-occipital) connections and the synchronism of the work of the front-frontal divisions are significantly higher than in healthy subjects (Arpentieva et al., 2019; Nerobokova & Voronina, 2015). Despite the fact that the synchronization of biopotentials in various mental illnesses undoubtedly bears the imprint of the procedural flow, which must be taken into account when comparing them with individuals with IID; nevertheless, it can be noted that the above-described picture of the interrelationships of the cerebral cortex, which we got in the process of applying cross-correlation analysis is of a peculiar, as if “average”, “intermediate” character. Strengthening of the interrelation of distant parts of the cortex, characteristic of epilepsy and determining the occurrence of seizure generalization propagating neural activity is combined with a weakening of the interaction of the central parts with the frontal and occipital, determining the feature of mental structure with schizophrenia. The frequent occurrence of depressive disorders in patients with IID, with frequent and often pronounced suicidal tendencies, is also largely due to a change in their neuroactivity associated with a weakening of the control of the frontal hemispheres of the temporal areas closely connected with the limbic system generating emotions (Melnikova & Lapin, 2008). However, it is worth mentioning once again that such a comparison can only be carried out without taking into account the signs of a cognitive and emotional-volitional defect arising from the procedural-progressive course of mental disorders.

5. Conclusion

Thus, the study of the functional activity of the brain in individuals with IID and the data describing its structure in patients with signs of various mental disorders, together with the results of psychological experiments conducted earlier, indicates a coincidence of a large number of brain functioning indicators in the two selected groups. Accordingly, if we now consider the obtained evidence from the point of view of evolutionary diatropics, we can conclude that persons with IID are not just representatives of a special group of the human population, represented by highly intelligent, creatively gifted individuals. In the described group, genetically determined traits inherent in various mental disorders and lacking the properties of dynamic progression are combined with each other and, manifesting themselves on a highly effective neuro-functional basis, lose their inherent phenotypically pathological phenomenology, modifying the specified neurophysiological basis. From this point of view, intelligence is truly a synonym for the degree of efficiency of the brain, but the specificity of the latter is determined by the signs that manifesting themselves in the population in the most

explicit form, initially belonged to the pathological ones. We have to take into account that the development of intelligence is interrelated with the functions of language and speech activity because it is determined the evolution of homo sapiens (the co-evolution of human language and brain). Now, their presence in the human gene pool can be interpreted as one of the main means of the evolutionary process associated with the emergence of gifted individuals who are the driving force behind the development of the homo sapiens population.

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