

# Three-dimensional localization of brain bioelectric activity in gambling addiction and epilepsy

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**Abstract:** *the objective of this paper is to find localization sources of bioelectric brain activity in subjects with pathological gambling, and epilepsy*

## Keywords

Brain bioelectric activities, pathological gambling and epilepsy, dipole, projection, synchronization, EEG, alpha rhythm, three dimensional localization

## 1. Introduction

Nowadays patients suffering from gambling habit are consulting with the doctors more often than before. Most of the patients were observed to have chronic dependency of play station games and also on the casinos. In addition to these pathological disorders symptoms such as mental comfort in game situations and persistent mental discomfort without the usual habits were also identified. To determine the localization and pathological brain bioelectric activity, EEG of gambling addiction (the players) and in epileptic patients were recorded by electroencephalograph EEGA-21/26 "Энцефалон-131-03" (Medicom MTD company ) and was analyzed by three-dimensional source localization method.

## 2. Theory and method

Theoretical basis for finding the source of abnormal activity is that in the local zone where brain lesions associated with an excess pathological activity has an impact on the formation of electrical activity throughout the cerebral cortex [9]. Analysis of the impact and application of mathematical models allow a three-dimensional localization of sources of pathological activities, the area of their location and its degree.

Multi step investigation procedure in application software "Entsefalan-3D" is used for dipole representation of the structure of sources. Equivalent dipole characterizes the total electrical activity of nerve cells involved in the process of pathological excitation at a particular moment, and is located at the center of this neural firing [4].

Calculated equivalent dipole is represented in the form of dots in 3 dimensional orthogonal projections of the head in a Cartesian coordinate system. This particular representation of equivalent dipoles in an anatomically

oriented coordinate system allows correlating them with the corresponding tomograms of the brain of the investigated patient. This allowed us to bind them to specific brain structures.

The first EEG was subjected to visual analysis to detect the presence of pathological elements or characteristics of a violation of the normal functioning of the brain. Visual analysis of EEG in the players showed that the subjects had signs of dysfunction of the brainstem structures. Manifestations of these traits were:

Synchronization (hyper synchronization) in alpha-rhythm on all leads, which lasts for a few, seconds (Figure 1);

Synchronized discharges of generalized nature of all leads, the duration of discharges ranged from fractions of a second to two seconds, which were repeated after 1-4 seconds (Fig 2).

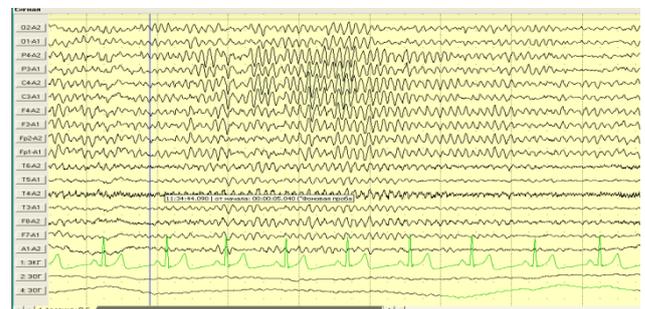


Fig. 1. Synchronization in alpha-rhythm

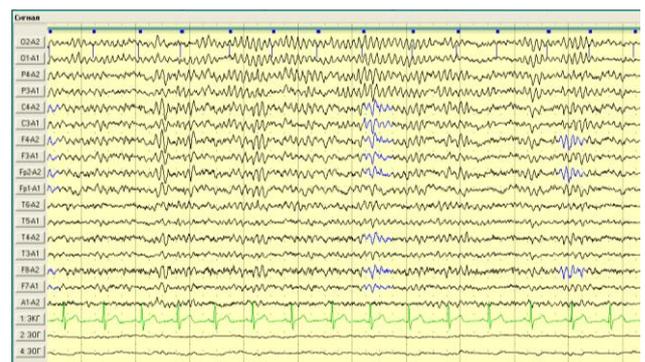


Fig. 2. synchronized discharges of generalized nature of all leads

Synchronization in alpha-rhythm and synchronized oscillations is an indicator of pathology of the anterior brainstem.

Method 3 dimensional localization was considered as a result of the visual analysis .We took EEG recording of duration 2 seconds, which observed the emergence of synchronized discharge. The total number of dipoles in a given period of time, also the number of dipoles in the right and left hemispheres in the middle, central-frontal and brainstem structures was determined.

### 3.Results and analysis

The number of dipoles in the right hemisphere is more than the left hemisphere for most of the players. And besides data of the visual analysis of brain asymmetry coincided with data from the three-dimensional localization method.

From the 3 dimensional localization table we can see the number of obtained dipoles for each of the chosen structures. Very few players were observed to have their dipoles in the stem structures but the remaining players were mainly having their dipoles in central-frontal structures. Dipoles of the players were located diffusely on the surface of cerebral cortex and also in mid brain structures. Two focuses were formed in the anterior and posterior brain regions as shown in the figure 3. Visual analysis and three-dimensional localization method suggest that the source of abnormal activity was located in deep brain structures.

The result of three-dimensional localization of EEG activity in epileptic patients showed more dipoles were located in the stem structure than the players, and the focus is located at the bottom, and affected the brain stem [10]. (Fig 4).

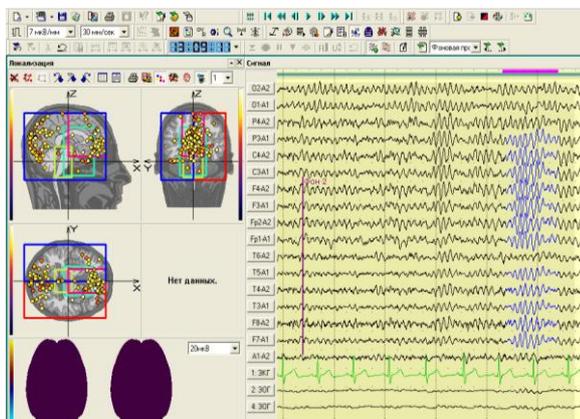


Fig.3. three-dimensional localization of sources of bioelectric activity of the players

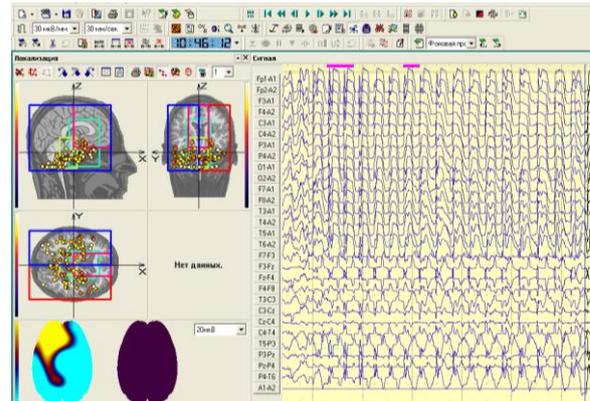


Fig.4. three-dimensional localization of sources of bioelectric activity in epilepsy.

So, we can consider some similarities between the players and for epileptic patients in localization of dipoles.

### 4.Conclusion

The three-dimensional localization in patients with epileptic activity indicates the presence of the hearth in the depths of the brain stem and in the midline structures. The overwhelming majority of surveyed patients with abnormal dependence on the game, the distribution pattern of the dipoles is located diffusely which is affected by the deep brain structure.

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## Biographies



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