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OCULOMOTOR ACTIVITY AND DYNAMICS OF SOCIAL PERCEPTION IN SCHIZOPHRENIC PATIENTS

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Abstract

The article presents the results of an experimental study of the dynamics of indices of oculomotor activity during the perception of the image of oneself and a participant in theater therapy in patients with schizophrenia as indicators of the optimization of the process of social perception. Research methods: laboratory experiment. The experiment was carried out using a hardware method for recording the movement of oculomotor activity using a stationary binocular eye tracking system. As a result of the study, data were obtained on the presence of statistically significant differences in oculomotor activity in patients after theater therapy. The perception of the image itself was accompanied by a decrease in the number of fixations, the frequency of fixations, the average duration of fixations, and the length of the image scanning trajectory. The perception of the participant in joint activity was accompanied by a decrease in the number of fixations, the frequency of fixations. On the contrary, the average duration of fixations increased, as did the image scanning trajectory. The perception of both types of images changed the indices of oculomotor activity in the selected areas of interest. The organization of joint activities of patients within the framework of theater therapy contributes to a change in the indicators of oculomotor activity in the perception of the image of oneself and the participants in the interaction, which reflect the positive dynamics of the characteristics of the social perception of patients with schizophrenia.

Keywords: Interpersonal interaction, joint activity, oculomotor activity, schizophrenia, social perception, theater therapy

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1. Introduction

The problem of studying joint activity as a factor in optimizing the process of social perception in patients with schizophrenia is associated with an analysis of the conditions of psychosocial therapy that can increase the effectiveness of treatment. In national pathopsychology, there is an understanding that disorders of communication and the process of social perception are an important component of the manifestation of schizophrenia (Andrianova, 2016; Bochkova, 2021; Khudyakova, 2017). The understanding of emotional expression by patients with schizophrenia was investigated (Chu et al., 2017; Gica et al., 2019), the peculiarities of their understanding of interpersonal communication (Abo-Elyzeed & Harfush, 2019; Chukanova, 2017; Tan et al., 2018), there is evidence of a decrease in their social intelligence (Rudenko & Rychkova, 2013), the presence of violations of understanding the situation of social interaction was revealed (Andrianova, 2016; Chebakova et al., 2018), etc. There are data, both in domestic and foreign psychology, on a decrease in the mental model in patients with schizophrenia (Andrianova, 2016; Penn et al., 2008). It has also been found in numerous studies that people with schizophrenia have difficulty understanding the behavior of others in interpersonal situations (Chukanova, 2017; Dorofeykova, 2017; Kosilova, 2016; Leontieva, 2018; Sprong et al., 2007). In the work of Rumyantseva (2015) it was found that for patients with diseases of the circle of schizophrenia, a decrease in cognitive functioning is characteristic, which entails difficulties in building a model of the mental of another person. However, as Andrianova (2016) points out: trainings aimed at the development of individual components of the ability to understand mental states, such as micro expression training, emotion recognition training by facial expression, gaze tracking training, and others, do not lead to an improvement in understanding social interaction in people with mental disorders, including those with schizophrenia (Fiszdon & Reddy, 2012; Kurtz & Richardson, 2012). This fact draws attention to the fact that when organizing psychosocial therapy for patients with schizophrenia, the emphasis should be placed not on training individual socio-cognitive functions, but on organizing joint activities of patients with deficiency in the implementation of social perception. Since, according to Andrianova (2016), in patients with schizophrenia, there is a deficiency in the correlation by patients of their own impressions with the perception of events by other people, which manifests itself in a violation of perceptual coordination. The implementation of joint activities in the conditions of theater therapy, in our opinion, can help to reduce this manifestation of this phenomenon.

The study of the oculomotor activity of patients with schizophrenia is used both to detect biomarkers of this disease (Benson & David, 2012; Shvaiko & Budenkova, 2015), and to understand the peculiarities of perception of various, including and social objects (Antonova et al., 2017; Dowiasch et al., 2016; Levy et al., 2010; etc.).

2. Problem Statement

The study, which studied the violation of understanding of the situation of social interaction in schizophrenia, undertaken by Andrianova (2016) allowed us to obtain data that were taken in our study as the basis for constructing lessons with the use of theater therapy. She found that impaired social interaction in schizophrenia is associated with a deficit in perceptual coordination. As a result of this

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disorder, patients with schizophrenia experience difficulties in establishing the coherence of communicative interaction and understanding the direction of the views and actions of the participants in communication.

In our opinion, the conditions that are modeled in theater therapy contribute to the actualization in patients of actions aimed at coordinating joint efforts, focusing on the behavior and reactions of another participant in the events within the framework of theatrical performance. These actions can ensure the development of perceptual coordination, forming the appropriate skill and thereby contribute to the effectiveness of social interaction of patients with schizophrenia.

Features of oculomotor activity in the perception of their own image and the image of theater therapy participants in schizophrenic patients and their difference from indicators of healthy people may indicate the nature of the dynamics of indicators of the process of social perception.

The study tested the following hypothesis: the gradual participation of schizophrenic patients in purposefully organized joint activity in theater therapy conditions can lead to changes in the indicators of social perception, which will be reflected in the characteristics of oculomotor activity when perceiving their image and participants in joint activity. The positive dynamics of indicators of social perception may be a consequence of the optimization of the process of perceptual coordination.

3. Research Questions

The study tested the following hypothesis: can the participation of schizophrenic patients in purposefully organized joint activity lead to a change in the indicators of social perception recorded in the dynamics of oculomotor activity during the perception of their image and participants in joint activity? Could the dynamics of indicators of oculomotor activity indirectly indicate the optimization of the process of perceptual coordination?

4. Purpose of the Study

The aim of the study was to study the dynamics of the indicators of oculomotor activity during the perception of the image of oneself and the participant in theater therapy in schizophrenic patients as indicators of the optimization of the process of social perception and comparing these indicators with data obtained in healthy respondents.

5. Research Methods

Research method: laboratory experiment using an eye tracker. The experiment was carried out with the use of a hardware method for detection of oculomotor activity by video recording of the participant's gaze movements, carried out by a stationary binocular eye tracking system Eye Tracker (model RED 500 System, produced by SMI (SensoMotorikInstruments GmbH, Germany). Initial processing of the basic characteristics of eye movements was produced by the BeGaze program of the Eye Tracker installation.

During the test, various parameters of oculomotor activity were recorded, including indicators of blinking, the number of fixations, the frequency of fixations, the duration of fixations, the number of

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saccades, the duration of saccades, the amplitude of saccades, the speed of saccades, the waiting time of saccades, and the length of the scanning path. The SPSS program was used to carry out statistical analysis of the data using the Student's t-test.

6. Findings

The study was carried out on the basis of the psychiatric department of the Saratov "State Clinical Hospital No. 2 named after V. I. Razumovsky" for 2 years. The sample consisted of patients diagnosed with schizophrenia (8 people) - an experimental group and healthy people (11 people) - a control group. Work was carried out with 2 therapeutic groups for 1.5-2 months each. All patients with schizophrenia at the time of the examination were in remission and did not show pronounced intellectual impairments and signs of delusional disorders. The study was carried out in two stages. At the first stage, an experiment was carried out using Eye-tracking, which pursued the goal of comparing the indicators of oculomotor activity in the process of smooth tracking movement in patients with a diagnosis of schizophrenia and healthy people. A dot appeared on the screen, carrying out horizontal movements according to a harmonic law with a frequency of 0.2 Hz. The patient had to observe the position of the black point for 30 seconds. Then, the trajectory of the gaze movement of patients and healthy subjects was analyzed in comparison with the trajectory along which the point performs oscillatory movements.

The data obtained in the control and experimental groups are presented in table No. 1.

Table 1. Indicators of oculomotor activity in the control and experimental groups

	Scanpath Length [px]		Saccade Count		Saccade Duration Total [ms]		Saccade Velocity Total [s]	
	Control Group	Experimental group	Control Group	Experimental group	Control Group	Experimental group	Control Group	Experimental group
Before therapy	3998,6	5457	87,6	94	39,6	31,55	40,92	50,2
After therapy	3836,2	5684	99,2	119,5	41,06	36,15	46,98	45,75

The scan path lengths in the experimental group significantly exceed the data in the control group. The ratio of the number of saccades in the two groups is also consistent with this trend. A greater number of saccades were found in patients with schizophrenia. Moreover, in this group, the average duration of saccades is shorter than in healthy subjects. When analyzing the speed of saccades before therapy, in the experimental group this indicator exceeded the data obtained in the control group. After therapy, this indicator is almost identical in the two groups.

Thus, when comparing the indicators of oculomotor activity in the process of smooth tracking movement in patients with a diagnosis of schizophrenia and healthy people before therapy, significant differences were revealed in all the identified parameters of oculomotor activity. After the therapy, the saccade speed stopped significantly differing in the control and experimental groups.

At the second stage, the features of oculomotor activity in the control and experimental groups were investigated when viewing sequentially presented images (each image was presented for 30 seconds). The order of presentation of photographs was as follows: a photograph of a stranger, a subject's own photograph, photographs of the participants in the performance. Eye-tracking recorded various

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indices of saccades, fixations, and blinks when viewing each new photograph. In each photograph, zones were also identified, in which the following parameters were recorded: viewing duration, number of fixations, average fixation duration. Before therapy, the patient's own photograph was viewed for a longer time. The patients paid attention to the eyes, nose and mouth. After therapy, the number of fixations decreased. When viewing photographs of the participants in the performance, both before and after therapy, more attention was paid to the eyes and nose. In addition, more prolonged fixations in the mouth area were identified, which was not observed when viewing a photograph of a stranger. This trend may indicate an increase in the importance of this zone, since it is associated with the implementation of communication. It should be noted that after the therapy, the total duration of viewing of all zones decreased when the images of the participants in the performances were perceived.

The dynamics of the oculomotor activity of patients when viewing three types of images is presented in tables No. 2, 3, 4.

Table 2. Dynamics of indicators of oculomotor activity when viewing your own image

Indicators of oculomotor activity in the experimental group									
	Fixation Count	Fixation Frequency [count/s]	Fixation Duration Average [ms]	Saccade Count	Saccade Duration Average [ms]	Saccade Amplitude Average	Saccade Velocity Average [s]	Average waiting time for saccades [s]	Scan path Length [px]
Before therapy	51,5	3,42	213	73,5	38,8	3,87	89,1	205	7052
After therapy	38	2,55	175	76,5	39	3,05	66,9	166	4522

When looking at your own photo after therapy, the values for the number of fixations, the frequency of fixations, and the average duration of fixations decreased. The number of saccades, the duration of saccades increased. The values of the velocity and amplitude of saccades after the performance became smaller. The average waiting time for saccades also decreased, which may indicate a lesser need to correct the direction of eye movements. The length of the scanning path was shortened after the performance. The indicated dynamics of indicators of oculomotor activity may indicate a decrease in the need to consider oneself, a greater recognition, and, consequently, the manifestation of meaningfulness in the perception of one's own photograph.

Table 3. Dynamics of indicators of oculomotor activity when viewing images of participants in the performance

Indicators of oculomotor activity in the experimental group								
	Fixation Count	Fixation Frequency [count/s]	Fixation Duration Average [ms]	Saccade Count	Saccade Duration Average [ms]	Saccade Velocity Average [s]	Average waiting time for saccades [s]	Scan path Length [px]
Beforetherapy	40,5	2,7	222,05	64,47	42,73	74,72	204,85	4577,79
Aftertherapy	28,85	1,93	295,45	55,5	40,73	89,3	319,25	4099,09

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When viewing photographs of the participants in the performance, the values for the number of fixations, the frequency of fixations decreased, and their average duration increased. This may indicate that patients are showing interest in participants in joint activities, which is manifested in a longer examination of their photographs. Turning to the data on the number of saccades, the duration of saccades, we also see a decrease in their values. The average speed and average waiting time of saccades increased in comparison with the first test, and the length of the scanning path became much shorter in the second test.

Table 4. Dynamics of indicators of oculomotor activity when viewing an image of a stranger

Indicators of oculomotor activity in the experimental group							
	Fixation Count	Fixation Duration Average [ms]	Saccade Count	Saccade Duration Average [ms]	Saccade Velocity Average [s]	Average waiting time for saccades [s]	Scan path Length [px]
Before therapy	39,7	262	77,25	44,4	72	175,27	5394,5
After therapy	28,7	222,6	75,5	39,3	104,4	221,05	5852,2

When viewing a photograph of a stranger, patients were characterized by a decrease in the number of fixations, indicators of fixation duration. The number of saccades and their duration also decreased, but the saccade speed indicators increased. The average saccade waiting time and the length of the scanning path increased. That is, the patients looked at the image, and it took them longer than before the therapy.

Based on the results of patients viewing all images of the participants, a statistical analysis was carried out using the Student's t-test (the data correspond to the normal distribution, the equality of Livinaya variances $p > 0.05$). The data are presented in table 5.

Table 5. Significant differences in the indicators of oculomotor activity of patients when viewing photographs of participants in the performance

Indicators of oculomotor activity in the experimental group				
	Fixation Count	Fixation Frequency [count / s]	Fixation Dispersion Total [px]	Average waiting time for saccades [s]
Before therapy	40,5	2,7	42,73	204,85
After therapy	28,85	1,93	40,73	319,25

There are significant differences in the number, frequency, and overall variance of commits. These indicators decreased after therapy. Significant dynamics was also revealed according to the results of the average waiting time for saccades, which increased after the performance. The revealed dynamics of the perception of photographs of the participants in the interaction indirectly indicates that patients have established a connection with communication partners, they recognize their faces better, and they look at photographs less.

The results of calculating the Student's t-test according to the data of the control group made it possible to reveal the difference only in the number of blinks when viewing the photographs of the participants. This indicator increased with repeated measurement, which indicates the manifestation of

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healthy participants in greater emotionality when viewing photographs of the participants in the performance.

According to the results of the study, at the first stage, differences in oculomotor activity were revealed during smooth tracking movement of the object in patients with schizophrenia and in healthy people. However, when analyzing the zones of interest in the course of free viewing of the face, the examination patterns in schizophrenic patients corresponded to the standard distributions of fixations characteristic of mentally healthy people.

At the second stage of the study, the analysis of general indicators of oculomotor activity showed that the patients underwent changes in the nature of the gaze movement after the organization of the formative experiment. Analysis of the dynamics of the oculomotor activity of patients in comparison with the control group before therapy shows that according to the data of the eye-tracker, patients have multiple fixations of short duration, with a wide scatter of their duration. The duration of fixations in the experimental group was almost 4 times less than in the control group. This can be an indicator of chaotic viewing of the faces of people with whom patients have no contact and, accordingly, do not focus their attention on the perception of their images. Taking into account the peculiarities of social perception disorders in schizophrenic patients, the obtained results may indicate that before therapy, patients fixed their gaze on several random areas of the face for a longer time, and then continued a quick examination of the face.

Indicators of saccades in patients of the experimental group in terms of speed and number are 2 times higher than those of the control group. This indicates a quick examination of persons, without the emergence of special interest in them. In the experimental group, the waiting time for saccades was 2 times less than in the control group. That is, very little time is allotted to correct eye movement between fixations, which can also indicate chaotic image viewing.

After therapy, fixations decreased, their duration increased, and the variance was similar to the data in the control group. It should be noted that the number of saccades has also decreased. At the same time, the average waiting time and saccade speed increased. That is, the subjects correct the movement of their gaze longer before the next fixation, and after that the saccade occurs more rapidly, and the fixation itself is already more informative.

Differences were found when viewing all three presented images - your own face, the face of a participant in performances and a stranger. The data indicate an increase in the interest of respondents with a diagnosis of schizophrenia in the image of a person who participated in the production of performances. The time for viewing your own image has decreased and interest in the image of a stranger has increased. Significant statistical differences were found in the perception of images of performance participants after therapy in terms of the number of fixations, the frequency of fixations, the total variance of fixations, and the average waiting time of saccades. The indicated dynamics of the indicators of oculomotor activity during the perception of photographs of the interaction participants indirectly indicates that patients began to recognize their faces faster, they need less time to scan their photographs, and they began to show more interest in them.

7. Conclusion

The experience of interpersonal interaction, simulated in the conditions of the performed theater therapy, turned out to be positive for its participants. It allowed patients to establish contact with group members, increased emotional involvement in joint activities and communication, and contributed to the development of social interaction skills and perceptual coordination. The positive dynamics was proved by the results of registration of oculomotor activity when viewing images that have a relationship with the peculiarities of the perceptual side of communication. The hypothesis put forward in this work that the organization of joint activities of patients within the framework of theater therapy contributes to changes in the indices of oculomotor activity during the perception of images of oneself and the participants in the interaction, reflecting the positive dynamics of the characteristics of social perception of patients with schizophrenia, was confirmed. The data indicate the emergence of interest in the group members, the desire to establish eye contact with a communication partner, which is combined with a calmer, more meaningful examination of the image of one's own face. For further socialization of patients with schizophrenia, it is advisable to use theater therapy as psychosocial therapy. However, it is necessary to take into account the peculiarities of the course of the disease, to devote enough time to preparing the performances, to ensure integrativeness in the activities of the group members, to include in it people who do not have a psychiatric status, in order to expand the repertoire of ways of responding in a situation of interpersonal interaction of its participants.

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