

## Study and Analysis of Patients' Psychophysiological Characteristics of Post-Prosthetic Inflammatory Complications at Dental Implantation

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### Abstract

To find out the primary cause of post-prosthetic complications at dental implantation is still problematic in spite of up-to-date diagnostic equipment. The dentist often pays attention only to the clinical picture in the oral cavity without thinking about the predicting factor of the pathology. This study shows results of the analysis of patients' psychophysiological characteristics with post-prosthetic inflammatory complications at dental implantation. Using 3 diagnostic methods (laser doppler flowmetry, a questionnaire, software) psychoemotional stress at the dentist's was diagnosed. The study proved the necessity of combined treatment making a positive impact both on the psychophysiological condition in general and as prevention of post-prosthetic complications at dental implantation. Stress prevention in patients with post-prosthetic complications at dental implantation is quite pressing in the present-day dentistry. Application of psychophysiological methods by the dentist is justified as it provides objective information about the reference stress level in the patient and other individual typological features.

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### Introduction

Emotional tension due to dental intervention, including implantation, pain the patient feels during treatment is determined to a great extent by their individual typological features<sup>1</sup>. In some combinations, emotiogenic pain factors may cause adaptation failure resulting in microcirculation impairment<sup>2</sup>. Medical practice shows that negative experience of previous dental visits causes, as a rule, a

persistent psychoemotional attitude to pain that is expected to feel even at the mere thought about coming treatment<sup>3</sup>.

Complex reaction of the human body to the situation of dental treatment directly in the consulting room involves emotional, behavioral and vegetative manifestations<sup>1,4</sup>. Fear, anxiety, anticipation of pain, bad mood, confusion and apathy refer to emotional manifestations<sup>5,6</sup>.

The works existing in this area are more often aimed at identifying the relationship between the patient's anxiety and the type of attitude towards the disease and its treatment. At the same time, it was shown that a low or moderate level of anxiety is more typical of people without accentuations. People with asthenic or excitable traits are more likely to have a pessimistic and less often a harmonic response to the disease. A high level of anxiety

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is also characteristic of such patients..

Thus, the use of psycho-diagnostic techniques at an outpatient dental visit is quite justified<sup>7</sup>. At the same time, the main requirements for them are the minimal number of tests, compactness, information content and relative ease of interpretation of the results<sup>8</sup>.

Revealing stress, psychoemotional disorder by objective and reliable methods is one of the main problems in healthcare.<sup>3,9</sup> In domestic and foreign literature there is information about the use of ECG, EEG, photoplethysmography as methods for diagnosing psychoemotional stress using various sensors<sup>3,9</sup>. Despite some progress in this area, researchers still pay great attention to the search for a reliable method to diagnose stress.

The Aim: To study the physiological characteristics of the body and assess the person's functional condition under emotional stress.

### Materials and methods

The study involved 1788 people at the age of 25-60 years who had regular medical check-ups after dental implantation. A clinical examination revealed post-prosthetic complications in 214 people (11.96%). Complications after dental implantation were not observed in 1574 people (88.04%). With the help of the examination algorithm, psychoemotional stress was observed in 185 people (86.4%) out of 214 who applied for help.

After the main and additional methods of dental examination, the patients were divided into 4 equal groups according to the treatment regimen.

All patients with post-prosthetic complications at dental implantation at a dental visit are given a basic treatment regimen<sup>10</sup>.

1. Patients' motivation on the issues of implantology, substantiation of the necessity and practicability of the treatment.
2. Observance of oral hygiene, teaching / correction of hygiene procedures carried out by the patient independently.
3. Correction of functional occlusion, selective grinding if necessary.
4. Sanation of the oral cavity.
5. Mechanical cleaning of the implant with a rubber tip and paste, removal of tartar with plastic instruments.

6. Antiseptic rinses with CHX - digluconate products (0.2% chlorhexidine solution).
7. "Metrogyl-Denta" application to the inflamed periimplant area.
8. Application of "Diplen film" as a system of local drug delivery.

In addition to the traditional treatment regimen, the patients of the second group underwent ozone therapy with the Ozotron apparatus (Fig. 1) in order to relieve inflammation and improve microcirculation in the oral cavity. Before ozonation of the oral cavity, all patients underwent a general clinical examination to find out contraindications to this method. Aeration of the inflamed tissue around the implant was performed in the following mode. The concentration of ozone in ozone / NO<sub>2</sub> - containing gas mixture is 2 g / m<sup>3</sup>. In this case, the ozone consumption was 0.5 l / min with 10 min. exposure (Fig. 1). One of ozone therapy complications directly in the oral cavity is ozone penetration into the body and its swallowing.



Figure1. Ozone therapy on the dental chair.

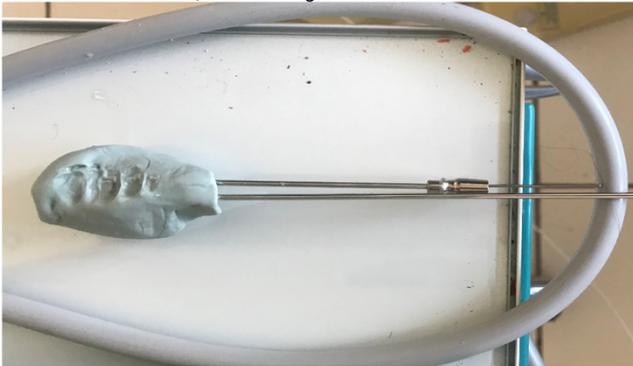
To prevent complications, ozone therapy was provided with the following regimen:

1. Pin fixation from the "Ozotron" apparatus in occlusive masks using a thermoplastic material (Fig. 2)



Figure 2. Pin fixation with thermoplastic material.

2. Mixing the C-silicone base component. Uniform coverage of the occlusal mask with a silicone material, so that all edges of the mask are covered with silicone and do not contact the mucous membrane (Fig. 3).



**Figure 3.** Pin covered with a silicone material.

3. Positioning in the patient's mouth, biting the mask, obtaining an imprint of the teeth (Fig. 4).



**Figure 4.** Preliminary fitting of the sample.

4. After silicone polymerization, the mask is removed from the oral cavity, checked for tightness, presence / absence of holes, cracks, etc. If necessary, additional silicone is mixed and tightness adjusted (Fig. 5).



**Figure 5.** Removing the mask from the oral cavity.

5. Fixation in the oral cavity due to natural undercuts and silicone density (Fig. 6).



**Figure 6.** Fixation in the oral cavity.

6. PVC tubes connected to the "Ozotron" are fixed to the pins of the apparatus (Fig. 7). Directed aeration of the inflamed tissues around the implant is performed, while the tightness of silicone adhesion to the tissues in the oral cavity minimizes the possibility of such complications as ozone penetration into the body.



**Figure 7.** Ozone therapy in the oral cavity.

Transcranial electrical stimulation was prescribed for the treatment regimen of the patients in the third group to normalize the psychoemotional condition of dental patients. The core of this method is non-invasive transcranial selective electrical stimulation of endorphinergic brain structures. As a result, the production of endogenous opioid peptides, primarily beta-endorphin, is increased. TES therapy relieves pain syndromes, stimulates reparative regeneration, restores and activates immunity, normalizes microcirculation and systemic blood flow, etc. The psychophysiological and emotional status, mood, motivational sphere are normalized, behavior, environmental and social adaptation are regulated.

The "Transair-04" apparatus was used for transcranial electrical stimulation. At the heart of

the electrical effect of the "Transair-04" is stimulation with an electric signal of a fixed frequency of 77.5 Hz, duration of 3.5 ms in the form of rectangular current pulses. In our study, transcranial electrical stimulation was performed using occipital and frontal electrodes connected to the apparatus.

During the first TES session the minimal value of the stimulating current was 0.8-1 mA for 20 minutes due to the adaptation of the body to physiotherapy. In subsequent procedures, the session duration was increased by 10 minutes, while the current strength and dosing was chosen individually for each patient..

The rationale to increase the dosage was subjective sensations - the feeling of vibration or slight tingling in the head. Since these unpleasant sensations almost completely disappear after 1-3 minutes, the current was subsequently increased discretely, gradually bringing it to 3 mA. After the lapse of time, the current strength was gradually reduced to zero, the patient was disconnected from the apparatus, and the electrodes were removed from the head. After the procedure, the patient rested for 15-20 minutes (Fig. 8).



**Figure 8.** Session of transcranial electrical stimulation.

Electrical stimulation was performed once a day. The course of treatment consisted of 12 sessions daily or every other day (Fig.8.). At the same time, the patients were informed that TES had a cumulative effect; it is strictly forbidden to interrupt treatment. No complications or side effects were found during TES therapy.

For patients in the fourth group, a combined method of treatment was included in the basic therapy regimen, consisting of a combination of ozone therapy and transcranial electrical stimulation.

Personal and emotional characteristics of

the patients were assessed using the following techniques:

1. Software based on photoplasmography.
2. Filling in a questionnaire.
3. Using LDF-metry data when calculating the centralization index - IC.

Using the software, based on the data obtained, the following was analyzed:

1. Assessment of the functional state of the body's regulatory systems based on an integral approach to the circulatory system as an indicator of the adaptive activity of the whole body.
2. Heart rate variability.
3. Choosing the optimal chemotherapy taking into account the body's psychophysiological characteristics.
4. Monitoring the effectiveness of therapy in dentistry, adjusting the drugs dosage;
5. Assessment of the stress level.

At the second stage, using the PSM-25 Psychological Stress Scale methodology, the general condition of patients with post-prosthetic inflammatory complications after dental implantation was assessed. The questionnaire for patients with possible answer options is presented in Table 1.

Statements	Points
1. I feel tense and nervous	1 2345678
2. I have a lump in my throat and / or I have a dry mouth	1 2345678
3. I am overloaded with work. I'm always running out of time	1 2345678
4. I swallow food quickly or forget to eat	1 2345678
5. I think over my ideas over and over; I change my plans; my thoughts are constantly repeating	1 2345678
6. I feel lonely, isolated and misunderstood	1 2345678
7. I suffer from ailments, have a headache, tense neck muscles, back pain and stomach cramps	1 2345678
8. I am absorbed in thoughts, worn out or worried	1 2345678
9. Suddenly I get hot and cold in turns	1 2345678
10. I forget about meetings or things I must do or make decisions about.	1 2345678
11. I can easily start crying	1 2345678
12. I feel tired	1 2345678
13. I clench my teeth	1 2345678
14. I am excited	1 2345678
15. It's hard to breathe and (or) I am suddenly short of breath	1 2345678
16. I have problems with digestion and intestines (pain, colic, diarrhea or constipation)	1 2345678
17. I am excited, worried or confused	1 2345678
18. I easily get scared: noise or rustle make me wince	1 2345678
19. I need more than half an hour to fall asleep	1 2345678
20. I am perplexed, my thoughts are confused, I cannot concentrate	1 2345678
21. I look tired with baggy lower eyelids or dark shadows	1 2345678
22. I feel a weight on my shoulders	1 2345678
23. I am anxious. I must always move, I cannot stay in one place	1 2345678
24. It is difficult to control my actions, emotions, mood or gestures	1 2345678
25. I feel tense	1 2345678

**Table 1.** Psychological Stress Scale PSM-25.

Information for patients. After each statement circle a number from 1 to 8 that most clearly expresses your condition for the last few days (4-5 days). There are no wrong answers or errors.

The points mean:

- 1 - never;
- 2 – hardly ever;
- 3 – very seldom;
- 4 - seldom;
- 5 - sometimes;
- 6 - often;
- 7 – very often;
- 8 - always.

By calculating the sum of points for all questions, the stress level was determined according to the following gradation: less than 99 points - low stress level; 100-125 points - average stress level; more than 125 points - high stress level.

It is important to note that while answering the questionnaire the patient tells about his conditions for the last 4-5 days.

At the third stage, using a laser Doppler study, the centralization index - IC was determined (centralization index, the degree of centralization of the heart rhythm control is determined). This indicates the degree of predominance of the central regulation loop activity over the autonomous one.

The LDF-gram was made in a sitting position, taking into account postural reflexes, in compliance with the terms of measurements standardization, including the same time of the day. The variability degree of microcirculation indices is presented in Table 2.

Factor	Variability degree
Menstrual cycle in women	+/-
Melanin content in the skin	+/-
Anatomical position of the flow-transducer	+++
Body position	+++
Room temperature	+++
Body temperature	++
Physical activity	++

**Table 2.** Variability degree depending on factors.

The protocol for the microcirculation study using LDF includes:

1. Determination of the average blood flow value in the intervals of registration time - M.
2. Determination of the average perfusion fluctuation relative to the average blood flow M -  $\sigma$  or RMS.
3. Determination of the variation coefficient – Kv

Diagnostics and treatment were provided within 1-14 days and as inflammation subsided in

the periimplant area. Regular medical check-ups and treatment were provided in the long term after 1,3,6,9 and 12 months.

## Results

Diagnostics of the psychoemotional stress level by adequate methods at different stages of treatment of dental diseases is relevant, since it can significantly improve the immediate and long-term results of therapy.

The study of stress was carried out in four groups of patients: 1) with conventional treatment; 2) with conventional treatment combined with ozone therapy; 3) with conventional treatment in combination with transcranial electrical stimulation; 4) with conventional treatment in combination with transcranial electrical stimulation and ozone therapy.

With a conventional method of treatment, psychological stress is noted to decrease to mild degree only 1 month after the procedure. By the 6th month, there was a characteristic peak in the value of the PSM-25 scale, which indicated an average level of stress in patients. Subsequently, there was a slow decrease in this indicator by the 12th month after the procedure.

Table 3 compares the values on the scale of psychological stress PSM-25 in the groups of patients with different therapy for post-prosthetic complications at dental implantation at different time intervals after a dental visit.

Indices of Psychological Stress Scale PSM-25	CT (n=30) Me, conv.units.	O (n=30) Me, conv.units.	TES (n=30) Me, conv.units.	TES+O (n=30) Me, conv.units.	hemp.	p
After 3 days	188,0*	175,0*	186,0*	162,5*	50,58	-5,47 x 10 <sup>9</sup>
After 7 days	166,0*	180,0*	160,0*	125,0*	95,80	-1,46 x 10 <sup>19</sup>
After 14 days	182,0*	117,5*	80,0*	25,0*	107,07	-6,40 x 10 <sup>20</sup>
After 1 month	120,0*	123,0*	75,0*	25,0*	101,71	-1,12 x 10 <sup>20</sup>
After 3 months	85,0*	85,0*	50,0*	28,0*	101,30	-9,78 x 10 <sup>19</sup>
After 6 months	135,0*	108,0*	113,0*	15,0*	97,96	-3,14 x 10 <sup>19</sup>
Через 9 months	96,0*	95,0*	75,0*	35,0*	101,04	-8,96 x 10 <sup>19</sup>
After 12 months	91,0*	90,0*	67,5*	22,5*	97,45	-2,63 x 10 <sup>19</sup>

**Table 3.** The level of psychological stress in groups of patients with different therapy for postprosthetic complications of dental implantation at different time intervals after a dental visit (Kruskal-Wallis H-test).

\* Statistically significant difference (p<0,01).

From Table. 3 it follows that the level of psychological stress after 3 days from the beginning of treatment of post-prosthetic complications at dental implantation was minimal in the group of patients with transcranial electrical stimulation and ozone therapy alongside with conventional treatment - the value of the PSM-25 psychological stress scale is 162.5 conv. units (interquartile range 145.0-175.0 conv. units). At the same time, the maximum level of psychological stress in the same time interval was in patients with conventional treatment - the value of the PSM-25 scale indicator was 188.0 conv. units (interquartile range 173.8-190.0 conv. units).

Noteworthy is the fact that the level of psychological stress in patients with conventional treatment in combination with transcranial electrical stimulation approached the maximum - the value of the PSM-25 scale was 186.0 conv. units (interquartile range 180.0-190.0 conv. units). The level of psychological stress in patients with conventional treatment in combination with ozone therapy had an intermediate degree of severity for a given time interval (between maximum and minimum) - the value of the PSM-25 scale index was 175.0 conv. units (interquartile range 160.0-180.0 conv. units).

Thus, the analysis of the results obtained using the PSM-25 Psychological Stress Scale, showed that there is a characteristic peak 6 months after the dental implantation in all patients, except for the group with conventional treatment, supplemented with transcranial electrical stimulation and ozone therapy. This time interval can be characterized as a kind of a critical period in the treatment of complications of dental implantation that corresponds to exacerbation of the clinical picture in the oral cavity.

Using the mobile application "Samsung Health" (version 6.9.0.055 and higher) for the Android operating system (version 5.0 and higher), the general condition of patients with post-prosthetic complications of dental implantation was assessed in the following time intervals from the start of treatment post-prosthetic complications: 3 days, 7 days, 14 days, 1 month, 3 months, 6 months, 9 months, 12 months.

The level of stress was calculated using the formulas for assessing the heart rate variability. The patient's actual heart rate was

compared with the normal value of this indicator in healthy people of the corresponding sex and age. In this case, the following gradation of stress levels was used: low, medium and high. This made it possible to compare the previously obtained results of the questionnaire survey with the data of the instrumental examination (Table 4).

Index Time intervals	SH	PSM-25	
	Conclusion about stress level	Me, conv.units	Conclusion about stress level
Before treatment	high*	154,8	high
3 days	high*	188,0	high
7 days	high*	166,0	high
14 days	high*	182,0	high
1 month	medium*	120,0	medium
3 months	low*	85,0	low
6 months	high*	135,0	high
9 months	low*	96,0	low
12 months	low*	91,0	low

**Table 4.** Comparative characteristics of the stress level according to the Samsung Health (SH) mobile application and the PSM-25 Psychological Stress Scale in the group of patients with conventional therapy for post-prosthetic complications at different time intervals after the treatment (n = 30).

\* Matching the stress level report with the corresponding PSM-25 report.

Comparing the stress level data obtained with the Samsung Health mobile application with the corresponding survey data using the PSM-25 Psychological Stress Scale methodology, it turned out that the conclusions on the stress level are practically the same. As it follows from Table 3.7.2.1, the stress level according to the data of the "Samsung Health" mobile application coincides with the corresponding values on the "PSM-25 Psychological Stress Scale" in patients from the group with conventional therapy of post-prosthetic complications after dental implantation at different time intervals after the procedure

In all groups of participants in the study, the personal data obtained by the self-assessment method almost completely correspond to the objective data of the instrumental examination. At the same time, it was noted that 3 months after the dental appointment, according to the Samsung Health mobile application, the patients from the group

with conventional therapy of post-prosthetic complications in combination with ozone therapy had an medium level of stress. At the same time, according to the results of self-assessment on the PSM-25 Psychological Stress Scale, the same patients experienced a low level of stress at the same time interval.

The heart rate variability was assessed using the hardware-software complex "Poly-Spectrum" (version 1.0.1.3; LLC "Neurosoft", Ivanovo). Based on the examination, the autonomic balance was analyzed in patients with post-prosthetic complications at the following time intervals after the dental visit: 14 days, 6 months, 12 months.

Table 5 provides information on the heart rate variability in the patients from the group with conventional therapy for post-prosthetic complications at dental implantation at various time intervals after a dental visit.

As follows from Table. 5, the stress level before the beginning of the treatment, made on the basis of the heart rate variability in patients from the group with conventional therapy of post-prosthetic complications, coincides with the corresponding values on the PSM-25 Psychological Stress Scale and the Samsung Health mobile application. The value of the centralization index (the ratio (LF + VLF) / HF, reflecting the degree of predominance of the activity in the central control circuit over the autonomous one) before the start of therapy was 5.8 conv. units (norm - 1.3-2.5 conv.units, medium stress level - 2.6-4.9 conv. units, high stress level 5.0 conv. units and more).

Indices Time intervals	SH	PSM-25	BCP	
	Conclusion about stress level	Conclusion about stress level	IC, Me, conv.units.	Conclusion about stress level
Before treatment	high	high	5,8*	high
14 days	low	low	4,4	medium
6 months	medium	medium	3,8*	medium
12 months	low	low	2,9	medium

**Table 5.** Comparative characteristics of the stress level according to the heart rate variability (HRV), the Samsung Health mobile application and the PSM-25 Psychological Stress Scale in the patients from the group with conventional therapy of post-prosthetic complications at different time intervals after a dental visit (n = 30). \* Coincidence of the conclusion about the level of stress with the corresponding conclusion to SH and PSM-25.

At the same time, in patients from the group with conventional therapy of post-prosthetic complications after dental implantation, the conclusion about the level of stress in different time intervals after the procedure performed according to the heart rate variability, did not coincide in some cases with the corresponding conclusions according to the PSM-25 Psychological Stress Scale and the Samsung Health mobile application. In particular, the value of the centralization index after 14 days from the start of treatment was 4.4 conv. units, which indicates a medium level of stress. At the same time, the conclusions made to the PSM-25 Psychological Stress Scale and the Samsung Health mobile application indicate a low level of psychological stress in patients in the same time interval.

The value of the centralization index 6 months after the start of treatment was 3.8 conv. units that indicates a medium level of stress. At the same time, the conclusions drawn from the PSM-25 Psychological Stress Scale and the Samsung Health mobile application also indicate the medium level of psychological stress in patients at the same time interval., The value of the centralization index in this group of patients was 2.9 conv. units 12 months after the start of treatment that still indicates a medium level of stress. At the same time, the conclusions drawn from the PSM-25 Psychological Stress Scale and the Samsung Health mobile application indicated a low level of psychological stress in patients at this time interval.

## Discussion

A significant reduction in stress level was observed in most patients 14 days after the treatment for complications had started. At the same time, the opposite trend is observed in the group with conventional treatment of complications: 1-3 months after the dental appointment, the stress level remains the same when complications are corrected by conventional treatment, supplemented by transcranial electrical stimulation, as well as conventional treatment in combination with transcranial electrical stimulation and ozone therapy. The stress level in all types of therapy increases slightly 6 months after the dental appointment, except for the group of patients with conventional treatment in combination with

transcranial electrical stimulation and ozone therapy. This correction method is characterized by a slight decrease by the 6th month and an increase by the 9<sup>th</sup> month. However, other types of treatment for post-prosthetic complications are characterized by a slow decrease in stress levels by the 12th month.

The methods for correcting complications used in the work can be arranged in a certain order depending on their effectiveness in relation to the level of stress. The most gentle is the conventional treatment in combination with transcranial electrical stimulation and ozone therapy. In this case, already 7 days after dental implantation, patients assess their stress level as low. Moreover, this trend persists over the next 12 months.

The stress level in patients of the second group becomes weaker only by the 10th day from the start of treatment and remains so for 12 months with an increase to the upper norm limit by 6 months.

When conventional treatment is used alongside with ozone therapy to correct complications of dental implantation, the stress level decreases even slower. It is only by the 10th day after the dental transplantation when the stress index on the PSM-25 scale reaches the value less than 125 conv. units that correspond to the medium level of stress. The intensity of stressful action continues to decrease and reaches a minimum by the 3rd month. At the same time, a small peak is observed by the 6th month, followed by a decrease by the end of the year from the start of therapy.

For the group of patients with conventional therapy of post-prosthetic complications of dental implantation in combination with transcranial electrical stimulation and ozone therapy, a low level of stress is noted in all time intervals after the start of treatment, which is confirmed by conclusions of all psychophysiological methods used to determine the level of stress. Therefore, it is this combination of therapeutic procedures that allows not only to normalize the dental patient's condition, but also to significantly improve the quality of their life by reducing the level of psychological stress.

The lowest level of psychological stress is observed in patients with conventional treatment of complications after dental implantation in combination with transcranial electrical

stimulation and ozone therapy in all time intervals within 1 year from the start of therapy. This allows us to consider this method as optimal, both in the short and long term.

Patients in the group with conventional treatment of complications in combination with ozone therapy showed in general moderate stress at the medium level within 1 year from the start of therapy. This method also worked well in the short and long term.

Patients from the group where conventional treatment was combined with transcranial electrical stimulation experienced a low level of stress during most of the analyzed intervals. On this ground in the short and long term this method can be considered close to the conventional treatment in combination with transcranial electrical stimulation and ozone therapy in terms of effectiveness.

In addition, the traditional treatment of complications of dental implantation led to the fact that patients objectively experienced a medium level of stress for 12 months from the start of treatment, which makes this method the least effective among those analyzed.

With regard to dental patients, the presence of initial psycho-emotional stress is one of the significant factors predisposing the development of inflammatory complications.<sup>11</sup> Stressogenic effects at the dental visit, as well as previous and subsequent periods are superimposed on the background psycho-emotional agitation<sup>11</sup>.<sup>12</sup> Thus, there is a potentiation of the effects that significantly increases the risk of complications, including inflammation, in patients with dental implantation<sup>12</sup>.

<sup>3,13</sup> Assessment of the psychophysiological characteristics of patients with inflammatory post-prosthetic complications at dental implantation confirmed the role of psychoemotional stress<sup>3,13</sup>.

It is generally accepted that in modern conditions a person continuously feels the influence of various stress factors. Moreover, the degree of their impact is constantly growing.<sup>14</sup> The most significant factor causing psychoemotional stress is the explosive growth of information that requires rapid processing and appropriate response<sup>14</sup>.

## Conclusions

The results of the study proved the necessity of a combined method of treatment as a method that has a positive effect on the psychophysiological condition of the body as a whole, and as prevention of the development of post-prosthetic complications at dental implantation.

The use of mobile devices equipped with a heart rate monitor and a pulse oximeter can practically without compromising the measurement accuracy replace in some cases traditional questionnaires designed to determine the level of psychological stress. This applies to a greater extent to young and middle-aged patients who are well adapted to everyday use of smart phones and smart watches. In this case, a mobile device will not be an additional stress factor which is very important for the measurement accuracy. Prevention of stress in patients with post-prosthetic complications after dental implantation is very important in up-to-date dentistry. Consequently, the use of psychophysiological techniques at the dentist is quite justified, since it allows one to obtain objective information about the patient's initial stress level and other individual typological characteristics. At the same time, the main requirements in this case are the minimum number of tests, their compactness and information content, as well as the ease of interpretation of the results.

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## Declaration of Interest

The authors report no conflicts of interest pertaining to any of the products or companies discussed in this article.

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