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RESEARCH

Characteristics of dental patients determining their compliance level in dentistry: relevance for predictive, preventive, and personalized medicine

Vadim V. Tachalov[1,2] · Lyudmila Y. Orekhova[3] · Elena R. Isaeva[4] · Tatyana V. Kudryavtseva[1] · Ekaterina S. Loboda[3] · Evgenya V. Sitkina[5]

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Abstract

This article centers on the relationship between psychological specifics of dental patients and their adherence to treatment. It describes clinical and personality specifics of periodontal patients and presents personality characteristics of patients with positive and negative dynamics of the therapy, as well as patients without periodontal diseases. The study findings highlight the importance of building confidential relationships with the patient and the need for a client-oriented approach to developing treatment plans and strategies for different types of dental patients. In the future, based on the study results, we find it necessary to elaborate more specific criteria for assessing personality characteristics of patients which determine their ability to comply with the doctor's recommendations. The dentist should not expect the success of their work without applying individual psychological approach to each particular patient. This knowledge means to help in further prognosis of the prescribed treatment and also can make the treatment more personalized and prevent non-compliance complications.

Keywords Compliance · Treatment adherence · Psychological specifics of patients · Relevance of treatment · Predictive preventive personalized medicine

Introduction

The word "compliance" is generally used by physicians in the context of medication therapy. Its synonyms include "patient's consent to follow the doctor's recommendations," "adherence to therapy," and "informed consent" [1]. WHO defines the term "compliance" as a "degree to which the patient is willing to take a medicine, follow recommendations on nutrition or lifestyles, and comply with doctor's instructions" [2, 3].

However, not much focus is given to patients' personality traits, their values, lifestyles, and social status. It is established that the majority of diseases have a multi-factorial genesis, which includes lifestyle and hereditary predisposition. It requires new approaches of the patient's treatment that could be provided by integrative medicine [4]. Failure to comply with the doctor's recommendations and prescriptions ("non-compliance") may be stipulated by different factors: social and economic factors (financial status, low cultural level, age of late adulthood), factors related to the disease (severity of symptoms, load associated with physical suffering, disease progression stage), factors related to therapy (complexity of regimen, duration of treatment, complicated choice of therapy, non-effectiveness of the prescribed therapy), factors related to the healthcare system (doctor–patient relationships, doctor's education level, capacity of the healthcare system, length of the medical consultation), and factors related to the patient (fear of unwanted side effects, early treatment termination, unfounded

✉ Vadim V. Tachalov
tachalov@mail.ru

[1] Therapeutic Dentistry and Periodontology Department, Pavlov First Saint Petersburg State Medical University, 6/8 Lva Tolstogo Street, St. Petersburg, Russia

[2] Pavlov First Saint Petersburg State Medical University, 6/8 Lva Tolstogo Street, St. Petersburg, Russia

[3] City Periodontology Center "PAKS", Dobrolubova prospect, 27, St. Petersburg, Russia

[4] Pavlov First Saint Petersburg State Medical University, Department of General and Clinical Psychology, 6/8 Lva Tolstogo Street, St. Petersburg, Russia

[5] Department of General and Clinical Psychology, Pavlov First Saint Petersburg State Medical University, 6/8 Lva Tolstogo Street, St. Petersburg, Russia

expectations, forgetfulness, and knowledge of the disease) [5, 6].

The term "personalized medicine" is the nowadays most optimal and innovative medical approach to make claim for grants and to acquire dedicated budgets. The existence of many different approaches reveals clear deficits existing in currently applied medical care and doctors' attempts to eliminate the deficits. The assumption that these deficits carry a fundamental character exists, so more global changes in medical services organization are required. It is evident that a new way is acquired to go from "reactive" to "predictive, preventive, and personalized medicine" as a new philosophy including both "healthcare" and "disease care." Promotion of integrated approach combining advantages of individual bio/medical fields and new technologies, consolidating a multiprofessional collaboration, should be performed [7].

Around 10% of all hospitalizations result from the failure to comply with the doctor's recommendations. A significant portion of expenditures related to hospital care also results from low compliance. The lack of information about studies of compliance in dental practice may indicate that the issue is poorly explored or is of little interest to dentists [8].

Establishment of constructive relationships in the "doctor–patient" system is the key to high compliance (adherence to treatment). In its turn, adherence to treatment has three main constituents:

1. Timely intake of medication;
2. Intake of medication in the prescribed dose; and
3. Compliance with nutritional and lifestyle recommendations [9].

An individual patient approach may help in detection of the early signs of the dental disease, and thus, it may help in contributing in early disease prevention [4].

There are several factors determining the patient's ability to follow instructions of a dentist. For example, 52–85% of patients experience fear, anxiety, and stress before attending a dentist; around 5% feel intense fear at the mere mention of a dentist [2]. According to some authors, persistent fear driving the patient to panic may result from a psychological trauma experienced in childhood, as well as incorrect behavior of the doctor, or severe pain.

One more important factor affecting the compliance is the patient's personality. For example, the way patients will monitor their health and follow the doctor's recommendations will depend on their age, character, values, and attitude to the disease [1, 10, 11].

Individual approach to the patient, ensuring their comfort and safety during the attendance, is the key to a successful work [12]. Doctors recognize the importance of building a trusting relationship with the patient and the need for an individual approach to the choice of strategies and the development of an individual treatment plan for different types of dental patients [11].

The present-day medicine is being reoriented to employing the system (holistic) model of treatment: patient's personality enters the foreground.

Doctor–patient system is prioritized in the development of individualized prevention and treatment programs in dentistry. A holistic and integrative approach could be provided by individualized medicine for medical care. It includes investigation of large groups of affected individuals, which promotes the discovery of the most effective ways of disease predicting and treatment [7].

The psychological characteristics of patients and their attitude to their dental health and hygiene of oral cavity are in close relationship. The behavior of dental patient after the prophylactic examination and conversation with the doctor is influenced by such characteristics with a high probability [13].

The goal of our study was to establish the relationship between personality characteristics of dental patients and their ability to comply with the doctor's recommendations.

Methods

A total of 45 people (25 women and 20 men) 19 to 67 years of age participated in the survey.

The indexes of periodontal treatment needs, gingival bleeding, and dental plaque, defined for the study participants, ranged from 0 to 1, which means that they had no gum bleeding and no dental plaque.

The study was carried out with the use of the following psychodiagnostics methods:

1. Multidimensional Health Locus of Control Scales [14]. This scale allows for determining the externality or internality of the control locus.
2. Interpersonal Relations Diagnostics test [15]. This test aims to study human relations and enables to define the prevailing type of attitude to other people.
3. Leonhard–Smishek Characterological Questionnaire (version for adults) is designed to diagnose the type of accentuation of personality traits [16].
4. Individual Typological Questionnaire by L.N. Sobchick (ITQ). This questionnaire contributes to defining such personality traits as extraversion–introversion, spontaneity–sensitivity, aggressiveness–anxiety, and rigidity–lability [15, 17].
5. Self-Assessment Questionnaire by the S.M. Kirov Military Medical Academy (SAQ). This method enables patients to assess their well-being and identify if they have physical complaints [18].

6. Personality Questionnaire of the Bekhterev Institute (PQBI) is designed to diagnose types of attitude to the disease [19].

The study was carried out to define the oral care and periodontal health indexes, as well as the index of treatment needs: (1) CPITN to measure the treatment needs [20]; (2) PMA, papillary marginal alveolar index, to assess the severity of gingivitis [21]; (3) Saxer and Muhlemann index to assess gingival bleeding [22]; (4) Silness and Loe index showing the thickness of plaque close to the gingival margin [23]; (5) OHI-S index to measure the area of tooth surface affected by plaque or tartar [24].

All the patients were examined by a dentist. Each patient was exposed to an objective assessment of the status of their teeth and oral cavity by dental health indexes. Afterwards, the study participants were interviewed by the doctor who provided recommendations on proper oral care and explained the importance of complying with these recommendations for improving periodontal health. The interview was followed by professional oral hygiene. A repeated examination was prescribed in 4 weeks.

Statistics

A comparative analysis using Student's t test was employed for the statistical processing of data, which is statistically significant at the commonly used significance level $p < 0.05$.

Results

Carrying out primary and repeated examinations of patients, we obtained dental indexes reflecting their compliance with medical recommendations and changes in their periodontal status in 2 weeks.

The findings are presented in Table 1.

The study findings show that the maximal value of dental indexes obtained at primary and repeated examinations does not exceed 1.3 for both men and women. This means that the objective status of oral cavity of the study participants was good. The majority of index values are under 1. This means that the patients have good oral care.

The indexes of periodontal treatment needs, as well as indexes of gingival bleeding, inflammation, and dental plaque, were normal in the study participants.

Based on the obtained data, we established that the status of patients' periodontium was improved by the repeated dental visits. This may result from their 2-week efforts to comply with oral care recommendations received at the primary examination.

Table 1 Mean values of dental indexes

Dental indexes	Primary examination		Repeated examination	
	M (SD)		*M* (SD)	
	Men ($n = 20$)	Women ($n = 25$)	Men ($n = 20$)	Women ($n = 25$)
CPITN	0.968	1.198	0.609	0.917
PMA	0.383	0.367	0.244	0.200
Saxer and Muhlemann	1.295	1.309	0.65	0.727
OHI-S	0.973	0.947	0.423	0.442
Silness and Loe	1.215	1.292	0.506	0.783

After analyzing data obtained through the oral care study, it was found that the sample of respondents included patients with good periodontal care (all indexes were equal to zero or tended toward zero). Table 2 presents the prevailing personality traits of these respondents.

Afterwards, we analyzed personality characteristics of patients with inflammation and poor periodontal hygiene. The patients were divided into groups with positive and negative dynamics in the status of oral cavity. Group 1 (positive dynamics) comprised patients whose dental indexes decreased by the second examination. Group 2 (negative dynamics) comprised patients with increased indexes. The comparative analysis of the two groups of female patients is presented in Table 3.

Table 2 Average values of personality characteristics of patients performing good oral care and lack of inflammations

Parameter	Women (W)	Men (M)
Multidimensional Health Locus of Control Scales		
I (internal locus of control)	24	16
P (external locus of control)	16	18
S (case control)	20	18
Interpersonal Relations Diagnostics test		
Altruistic type	13	8.5
Authoritarian type	10	12
Leonhard–Smishek Characterological Questionnaire		
Emotive type	21	9
Hyperthymic type	12	16.5
Individual Typological Questionnaire		
Spontaneity	8	7.5
Introversion	8	3
Extraversion	2	7
Personality Questionnaire of the Bekhterev Institute		
Harmonious type	3	2
Anosognosic type	2	3

Table 3 Comparative analysis on personality characteristics of female patients from positive and negative dynamics groups

Parameter	Women respondents (W)		Statistical significance
	Group 1 ($n = 12$)	Group 2 ($n = 11$)	p
Multidimensional Health Locus of Control Scales			
I (internal locus of control)	21	18	$p < 0.05$
Interpersonal Relations Diagnostics test			
Altruistic type	10.8	13	$p < 0.05$
Leonhard–Smishek Characterological Questionnaire			
Emotive type	17.6	22.5	$p < 0.05$
Dependent type	5.7	10	$p < 0.05$
Stuck-up type	16.8	12	$p < 0.05$
Individual Typological Questionnaire			
Introversion	6.2	4	$p < 0.05$
Personality Questionnaire of the Bekhterev Institute			
Anosognosic type	2.5	0.5	$p < 0.05$

Discussion

Around 250 articles were selected in 2018 by Springer in all areas that have a potential opportunity to change the world. Such categories as groundbreaking scientific findings that could help people and protect our planet were included in this list [25]. Also, 60 articles in the category Medicine and Public Health have been selected [26]. One of these articles published by the *Nature Reviews Clinical Oncology* contains patients' self-reports [27]. The paper highlights the important role of the patient experience as a key measure of healthcare quality. It is important that the leading principle of personalized healthcare is attentive and thorough communication with patient.

A review made about the interventions used in periodontal treatment had the cognitive behavioral approach (psychological interviewing) backgrounds, including motivational interviewing and a patient self-care commitment model. The control group in each study was described receiving standard information. The outcomes of the procedures were divided into such groups: (1) clinical findings, (2) self-reported self-care, and (3) patient assessment of the procedures. The groups provided with psychological interviewing procedures shoved slightly better result than the control groups when clinical outcome measures such as the presence of plaque or number of periodontal pockets were used. Psychological interviewing procedures increased patient-reported compliance (e.g., effectiveness of self-care and frequency of interdental cleaning). The different psychological interviewing methods all shoved higher effectiveness than standard instruction [28–33].

A study of patients' compliance who underwent periodontal therapy and needed some maintenance procedures revealed that adherence to treatment and following doctor's prescriptions differed in various social groups. It showed that non-working class group had poor level of compliance and in the same time working people were more accurate in following doctor's recommendations [34].

The retrospective study was carried out to assess compliance of periodontal patients in a private practice to investigate the "risk profile" of the non-compliant patient. The results showed a low compliance of the patients with a mean period of supportive periodontal therapy attendance of 20 months. Severity of periodontal disease at the time of diagnosis was positively associated with the completion of non-surgical periodontal therapy. Smoking patients were revealed to have less time of remaining in maintenance [35].

Some investigations reveal that the compliance level could be increased by motivating procedures, such as reminding next visit, informing patients on both periodontal disease and importance of maintenance, and motivating the patient who showed an improvement in compliance [36].

B. Iwata reports about the effectiveness of financial motivation of the patients. The author assumes that other forms of reinforcement (e.g., spouse contracts, self-recording, home-based token reinforcement procedures for children, and even systematic social praise) might enhance the effectiveness of current educational practices [37].

The personalized psychological interviewing is more helpful for patient adherence and may therefore improve initial periodontal treatment success. However, there is a need to further explore the use of different methods in studies with larger group sizes, longer period of observation, and both psychological and clinical outcome measures [38]. Such approach can prevent complications of individual's non-compliance behavior.

It was evidently presented by A. Kunin et al. that patients' self-reports can provide doctor information that can help in early detection of symptoms of syndromes and co-existing and snowballing health-threating conditions. It can help doctor to select individuals at high risk; consequently, targeted preventive measures can be started early in life. It was also mentioned that psychological factors (obsessional personality/perfectionism) play an important role in clinical manifestation and deterioration of the disease, especially "dry mouth" syndrome, which leads to other mouth pathology: chronic periodontitis, dental caries. It is very important that such a disease can be predicted by self-control methods and prevented or treated in early stage with positive therapeutic effect [39].

We obtained psychological characteristics of the patients adherent and not adherent to periodontal treatment in our study.

Female patients with good dental health status have an internal locus of control, i.e., they recognize responsibility for their health. They are altruistic in interpersonal relationships and emotive in character. Such patients perform a

harmonious type of attitude to the disease. This means that, despite the fact that these patients are more drawn to their inner world, they care about the people around them and also about their health.

In other words, a woman with good status of oral cavity and teeth is characterized by high internal responsibility. An introvert, she is emotionally vulnerable and impressionable. She is attentive and caring in relations with others and has strong views on her health and treatment. It means that she assesses her health status appropriately and is ready to meet the recommendations of her doctor. The doctor needs to build relationships with such type of patients in account of their increased responsibility. These should be relationships of emotional support, understanding, and comfort. All information and recommendations should be clearly structured.

Male patients with good status of teeth and oral cavity have an external locus of control, i.e., they shift responsibility for their health to the doctor. They are authoritarian in interpersonal relationships, hyperthymic in temperament, and anosognosic in their attitude to the disease ("that's no big deal," "there's nothing to worry about," "just leave it," "things will come right"). In regard to their health, men more often than women leave things to chance rather than take much care of their health. They are extraverts, making major gains in their professional life, as they have a lot of contacts and seek success and power. This type of patients also requires an individualized approach from the doctor. The doctor's argumentation should be strong and well-structured to explain the need to monitor their health and comply with recommendations. The doctor can choose arguments that have a strong emotional effect on the patient. It is advisable that some of the patient's family members maintain external control over the fulfillment of the doctor's instructions.

It was established that women from the positive dynamics group had higher internal locus of control, i.e., they relied only on themselves in taking care about their health. Altruistic type of interpersonal relationships and emotive type of temperament prevailed in both groups of women. However, group 1 also included patients with stuck-up temperament, and group 2—representatives of a dependent type. Women performing the improvement of oral cavity status are more introverted, whereas women with the deteriorating status of oral cavity are more sensitive. Representatives of both groups showed a prevailing harmonious type of attitude to the disease. However, the prevalence of the anosognosic attitude to the disease was statistically significant in group 1 alone. The comparative analysis of positive and negative dynamics groups of male patients is presented in Table 4.

It was established that men from group 1 had a higher internal locus of control than patients of group 2. Group 1 was characterized by authoritarian type of interpersonal relationships. Aggressive type prevailed in group 2. It means that patients that are accurate in following the doctor's recommendations are more confident and independent and more active in achieving their goals, whereas patients with negative dynamics are distrustful and hostile to others. Men of a stuck-up temperament were widespread in the negative dynamics group. They were characterized by suspiciousness and concentration on their personal concerns. Demonstrative type prevailed in the positive dynamics group. Men of this type of temperament are characterized by increased emotional activity and agility. They always strive to be in the spotlight. Patients of both groups are prone to spontaneity and lack of judgment in what they say and what they do. It should be noted that both men and women from group 1 are anosognosic (or euphoric) in their attitude to the disease, i.e., they remain optimistic regarding the treatment: they hope that their health problems are minor and easily curable. At the same time, group 2 patients are neurasthenic in their attitude to the disease, i.e., they are intolerant to the pain and unable to endure and wait until the feeling of discomfort disappears.

Table 4 Comparative analysis on personality characteristics of male patients from positive and negative dynamics groups

Parameter	Men respondents (M)		Statistical significance
	Group 1 ($n = 10$)	Group 2 ($n = 8$)	p
Multidimensional Health Locus of Control Scale			
I (internal locus of control)	21	15	$p < 0.05$
Interpersonal Relations Diagnostics test			
Authoritarian type	9.4	6.5	$p < 0.05$
Aggressive type	7.7	8.5	$p < 0.05$
Leonhard–Smishek Characterological Questionnaire			
Stuck-up type	12.6	18	$p < 0.05$
Demonstrative type	11.7	1	$p < 0.05$
Individual Typological Questionnaire			
Spontaneity	6	7.5	$p < 0.05$
Personality Questionnaire of the Bekhterev Institute			
Neurasthenic type	1.2	2.5	$p < 0.05$
Anosognosic type	3.6	1	$p < 0.05$

Conclusions

1. By the degree of their compliance with the doctor's recommendations, the patients were divided into two groups: (1) patients with good oral care and lack of periodontal inflammation and (2) patients with poor oral care and periodontal inflammations, complying and non-complying with medical advice. The study revealed differences between these two groups in personality traits of their representatives.

2. Women and men with good periodontal status differed in personality characteristics. Women properly assessed their situation and relied on themselves in taking care about their health; they were willing to follow recommendations of their doctor. Men with good periodontal health status more often left things to chance regarding their health; however, they were more goal-oriented, socially active, and communicable.
3. Female patients adherent to fulfillment of the doctor's recommendations were more introverted, more "meticulous," and diligent. Women with negative dynamics were less emotionally stable, had deflated self-esteem, and were more vulnerable and dependent on their environment.
4. Male patients with positive dynamics relied on themselves in taking care of their health and were more optimistic, goal-oriented, and independent, trying to make overall positive impression. Men with negative dynamics were more distrustful, aggressive, and reserved and fearful and intolerant to physical pain, feeling discomfort of treatment procedures.

Expert recommendations

The study revealed statistically significant differences in personality profiles of compliant and non-compliant patients. Depending on their personality specifics, the patients differed in the manner they fulfilled the doctor's instructions.

The study findings highlight the importance of building confidential relationships with the patient and the need for a client-oriented approach to developing treatment plans and strategies for different types of dental patients.

In the future, based on the study results, we find it necessary to elaborate more specific criteria for assessing personality characteristics of patients which determine their ability to comply with the doctor's recommendations. The dentist should not expect the success of their work without applying individual psychological approach to each particular patient [40]. Further studies will allow for developing a method of effective psychological diagnostics of patients before the treatment starts. Following this diagnostics, we will divide the patients into groups in order to select more precisely the strategy and tactics of patient management.

A holistic presentation of individuals and discoursed health condition by information and communication technologies (ICT) approach implies a redesign of healthcare services. The ICT support is the prerequisite for an effective PPPM by disease modeling, individualized patient profiles, and optimized diagnostic and treatment approaches [7].

The findings empower the dentist to foresee the patient's preparedness to follow recommendations on oral care and good health. They also enable the doctor to work out an individual treatment plan for patients that meet their specifics and compliance level. Individualized approach will ensure more thorough assistance to patients and, as we presume, will increase their compliance. The increased compliance in its turn will result in the reduction of dental diseases.

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Authors' contributions VT made a substantial contribution to the development of the concept and design, collection of data, and analysis and interpretation of data; participated in the drafting and revision of the manuscript; provided the final approval of its version to be published; and agreed to be accountable for all aspects of the work to ensure that issues related to the accuracy or integrity of any of its parts are appropriately addressed.

LO participated in revising the content of the manuscript critically, provided the final approval of its version to be published, conceived the study, participated in study design and coordination, and helped with drafting the manuscript.

TK participated in drafting the manuscript, collection of data, and study design and coordination and helped with drafting the manuscript.

EI provided data analysis and interpretation, revised the content of the manuscript critically, participated in the design of the study and performed the statistical analysis, and helped with drafting the manuscript.

EL was responsible for data collection, participated in the design of the study and performed the statistical analysis, and helped with drafting the manuscript.

ES contributed to the concept and design, analysis, and interpretation of data; participated in developing the manuscript and making corrections or critical criticism for important intellectual content; and helped to draft the manuscript.

All the authors read and approved the final manuscript.

Compliance with ethical standards

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Our study was approved by the Ethical Committee of the First Pavlov State Medical University of Saint Petersburg #01-2017. All the patients were informed about the purposes of the study and have signed their "consent of the patient."

Competing interests The authors declare that they have no competing interests.

Consent declaration All individuals were informed about the purposes of the study and have signed their consent for publishing the data. Patients were informed about the purposes of the study and have signed their consent for publishing the data.

Abbreviations *SMU,* First Saint Petersburg State Medical University; *PMA,* papillary marginal alveolar index; *LSC,* level of subjective control test; *OHI-S,* index of Greene–Vermilion; *WHO,* World Health Organization; *CPITN,* community periodontal index of treatment needs; *PQBI,* Personal Questionnaire of the Bekhterev Institute; *ITQ,* Individual Typological Questionnaire by L.N. Sobchick; *ICT,* information and communication technologies

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