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PREDICTING THE RISK OF DENTIN SENSITIVITY DEVELOPMENT IN DENTAL PATIENTS

Abstract. The main predisposing factors for DS occurrence and development in dental patients have been identified, and the DS prognosis program and the DS prognosis index have been developed.

The program and the prognosis index were tested in 95 dental patients. The control group consisted of 30 patients. Clinical parameters were assessed before treatment, after 1 week, and 1, 6, 12 months. The treatment effectiveness was assessed using the number of good, satisfactory, and unsatisfactory treatment results in each group.

The results of clinical observation of patients showed that the use of the DS prognosis program and the DS prognosis index makes it possible not only to clearly inform patients about the level of risk of developing DS, but also to constantly monitor prognostic signs, which increases the treatment effectiveness by 47 %.

Good treatment results in 97 % of cases in a long-term period determine the feasibility of including the program we developed and the prognosis index in the complex treatment of DS in dental patients.

Keywords: prognosis, dentin sensitivity, dental patients, risk factors

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ПРОГНОЗ РИСКА РАЗВИТИЯ ЧУВСТВИТЕЛЬНОСТИ ДЕНТИНА У СТОМАТОЛОГИЧЕСКИХ ПАЦИЕНТОВ

Аннотация. Выявлены основные предрасполагающие факторы возникновения и развития чувствительности дентина (ЧД) у стоматологических пациентов, разработана программа «Прогноз ЧД» и рассчитан индекс прогноза ЧД.

Программа и индекс прогноза апробированы у 95 стоматологических пациентов. Контрольную группу составили 30 пациентов. Клинические параметры оценивали до лечения, через 1 неделю и через 1, 6, 12 мес. Эффективность лечения оценивалась по количеству хороших, удовлетворительных и неудовлетворительных результатов лечения в каждой группе.

Результаты клинического наблюдения за пациентами показали, что использование программы и индекса прогноза ЧД позволяет не только информировать пациентов об уровне риска развития ЧД, но и постоянно контролировать прогностические признаки, что повышает эффективность лечения на 47 %.

Хорошие результаты лечения в 97 % случаев в отдаленном периоде наблюдения определяют целесообразность включения разработанной нами программы и показателя прогноза в комплексное лечение ЧД у стоматологических пациентов.

Ключевые слова: прогноз, чувствительность дентина, стоматологические пациенты, факторы риска

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Introduction. Dentine sensitive (DS) – is an independent nosological disease, which is manifested by an increased differentiated reaction of the tooth to irritants with a transient response to targeted dental treatment [1]. Among patients with periodontal diseases, DS is diagnosed in 61–98 % of cases [2, 3]. The difficulties in diagnosing and treating dentin sensitivity in this category of patients lie in the variety of its clinical manifestations. The difficulties of understanding the mechanism of its development are also associated with the dynamic change in unfavorable factors affecting the quality of life. In the Republic of Belarus, DS is classified according to its form, topography, prevalence, course and severity.

It should be noted that the dynamic balance of the biological periodontal system in dental patients with DS is due to the interrelation of anatomical and reflex mechanisms that influence the morphological and clinical manifestations of the pathological process. The mechanism of development of respiratory depression in dental patients requires constant review and clarification. At the same time, timely diagnosis of DS in dental patients makes it possible to predict and adequately plan treatment measures [4, 5].

DS is accompanied by exposure of the root surface and opening of the dentinal tubules, which accompanies gingival recession. At the same time, errors in brushing teeth, bad habits, anomalies in the position of teeth in the dental arch, incorrect orthodontic treatment, inflammatory-destructive and involutive processes in periodontal tissues contribute to the development of DS [6–10]. In addition, experimental studies have established that certain foods (red and white wine, citrus fruit juices, apple juice, yogurt) lead to the removal of the smear layer of dentin and the opening of the entrance to the dentinal tubules [11–14]. It should be noted that DS in some individuals with psychosomatic disorders, dysfunctions of the endocrine glands and mineral metabolism in the body, properties of oral fluid, atherosclerotic stenosis of the carotid arteries [15–17].

Considering the variety of predisposing factors and clinical manifestations of DS, there is a need to predict the development of DS in dental patients [18–28].

The aim of the study – to develop a prediction of the development of dentin sensitivity (DS) in dental patients using a computer program in combination with a clinical prognosis index.

Materials and research methods. The study was conducted on volunteer patients in accordance with clinical protocols approved by the Ministry of Health of the Republic of Belarus. The study included 30 practically healthy individuals, 95 patients with verified true and symptomatic DS who applied to the Department of Periodontology of the Belarusian State Medical University. All patients signed informed consent.

Clinical researches. Clinical parameters were assessed before treatment, after 1 week, and 1, 6, 12 months. Data from clinical examinations were entered into the dental outpatient card and the developed examination card for the patient with DS. Based on the data obtained, the condition of hard tissues and pulp of teeth, periodontium, and oral fluid was assessed. The effectiveness of treatment was assessed based on the number of good, satisfactory and unsatisfactory treatment results in each group.

In order to select targeted therapeutic and diagnostic measures and determine the frequency of individual follow-up, prognostic criteria were used. To assess the likelihood of developing DS, the computer program "Prognosis of DS Development" was used, which included the characteristics of prognostic criteria that were determined before treatment of patients and during control visits throughout the study period.

Statistical analysis. Data processing was carried out using the Statistica 10.0 software package for Windows (USA). The results were expressed as the arithmetic mean (M) ± standard error (m). Indicators were considered statistically significant at $p < 0.05$.

Characteristics of groups. Among the 95 dental patients with DS, there were 56 women and 39 men, their ages ranged from 25 to 54 years (mean age 37.4 ± 8.4 years). All patients were equally distributed in two groups depending on diagnosis, gender and age. 41 patients of the first group were diagnosed and treated for DS according to clinical protocols. In the second group of 54 patients, treatment and diagnostic measures were carried out according to clinical protocols, including prediction. 30 practically healthy patients formed the control group.

Results and its discussion. At the Department of Periodontology of the Belarusian State Medical University, the prediction of DS in dental patients has been developed using the program "Prognosis of DS Development" in combination with the DS Prognosis Index (DSPI) [21].

Determination of the DS status was carried out by analyzing prognostic signs of dentin sensitivity in dental patients. The 8 prognostic criteria for the likelihood of developing DS in this program include: frequency of detection of complaints of tooth sensitivity (teeth); general unfavorable factors (stress, carotid artery stenosis, endocrine dyscorrelations, etc.); signs of parafunctions; eating foods with low pH; indicators of the complex differentiated dental sensitivity index (CDDSI) (L. N. Dedova, 2004); number of teeth with DS (prevalence of DS in the patient); increasing the excitability of the dental pulp to electric current by % of the "norm"; indicators of the gingival recession index IR [22]. The above prognostic criteria were entered into a computer program (see Table).

Prognostic criteria probability of development DS

Prognostic criteria (predictor)	Probability					
	low	medium			high	
	1 point	2 points	3 points	4 points	5 points	6 points
Complaints of sensitivity of the teeth (frequency)	Once every 2 months	1 time per month	Once every 3 weeks	1 time every 2 weeks	1 time per week	Daily
General unfavorable factors (no, risk, yes)	No	No, low risk	No, high risk	Yes, compensated course	Yes, subcompensated course	Yes, decompensated course
Signs of parafunctions (no, yes, complaints)	No	No, complaints	Yes, complaints	Yes, nighttime with complaints	Yes, daytime with complaints	Yes, daytime and nighttime with complaints
Eating foods with low pH	1 time per month	1 time every 2 weeks	1 time per week	2 times per week	1 per day	2 times a day
Complex differentiated dental sensitivity index (CDDSI)	0.1–2.0	No more 3.0	No more 4.0	No more 5.0	No more 6.0	Before 10.0
Number of teeth with DS	1–2	1–4	1–6	1–8	1–10	11–32
Increasing the excitability of the dental pulp to electric current, % of the norm	30–40	No more 50	No more 65	No more 75	No more 90	Before 100
The gingival recession index IR	1–25	No more 35	No more 45	No more 55	No more 75	Before 100

Each parameter of the programmed chart has a measurement scale. All prognostic criteria were interpreted depending on the level of probability of development and progression of DS (low, medium, high). The low-risk area was located at the center of the polygon, while the high-risk area was located at its periphery. In their center there is a zone of medium risk for the development and progression of DS.

A comprehensive assessment of prognostic criteria determined the individual level of risk for possible disease progression and the follow-up interval. The program "Prognosis for the development of DS" calculates the area of filling the polygon of the functional prognosis diagram as a percentage.

Thus, the filling of the polygon was highlighted in three colors depending on the risk level: low level corresponded to green, medium to yellow, and high to red (Fig. 1–3).

The diagram shows a program-graphic characteristic of DS, which demonstrates the level of risk of its progression. At the same time, prognostic criteria for DS were used to calculate the dentin sensitivity prognosis index (DSPI), which shows the level of development of DS in dental patients in a digital characteristic. The combination of a developmental prognosis program in combination with IPD makes it possible to plan targeted individual treatment and preventive measures (see Table) [22].

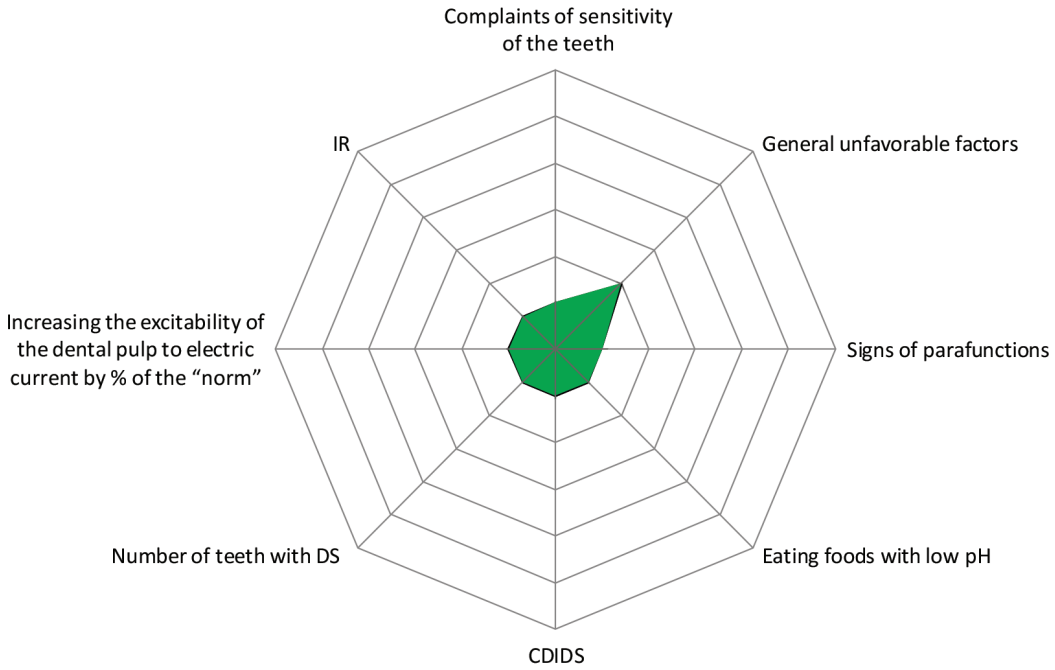
It should be noted that DSPI is scored based on the presence of one or more manifestations of each of the 8 prognostic criteria:

$$\text{DSPI} = \frac{\text{prognostic criteria for the likelihood of developing DS } (\text{in points})}{6 \text{ (in points)}} \cdot 100.$$

Based on the index indicators, the following assessment can be made DSPI: 16.7 % – good, compensated condition; 33.3–66.7 – satisfactory condition; 83.3–100 % – state of decompensation.

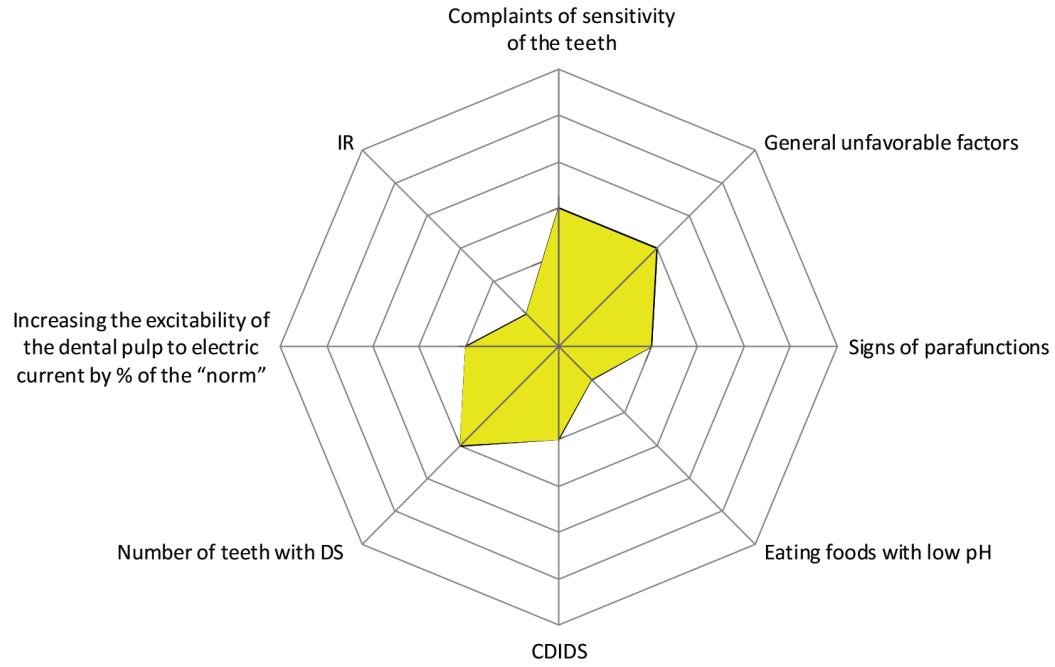
Using the index indicators, in 76.01 ± 1.63 % of cases it was enough to carry out a short-term recourse of treatment for DS or limit oneself to partial treatment and preventive measures; in 21.56 ± 1.1 % of cases, patients were recommended only rational care for the oral cavity even before relapse of DS.

The results of clinical observation of patients showed that the use of prognostic criteria of the program and the prognosis index made it possible to obtain good results of treatment of DS in dental patients in the main group in 97 % of cases in long-term follow-up periods compared with 50 % of cases in the group where no prediction was made.



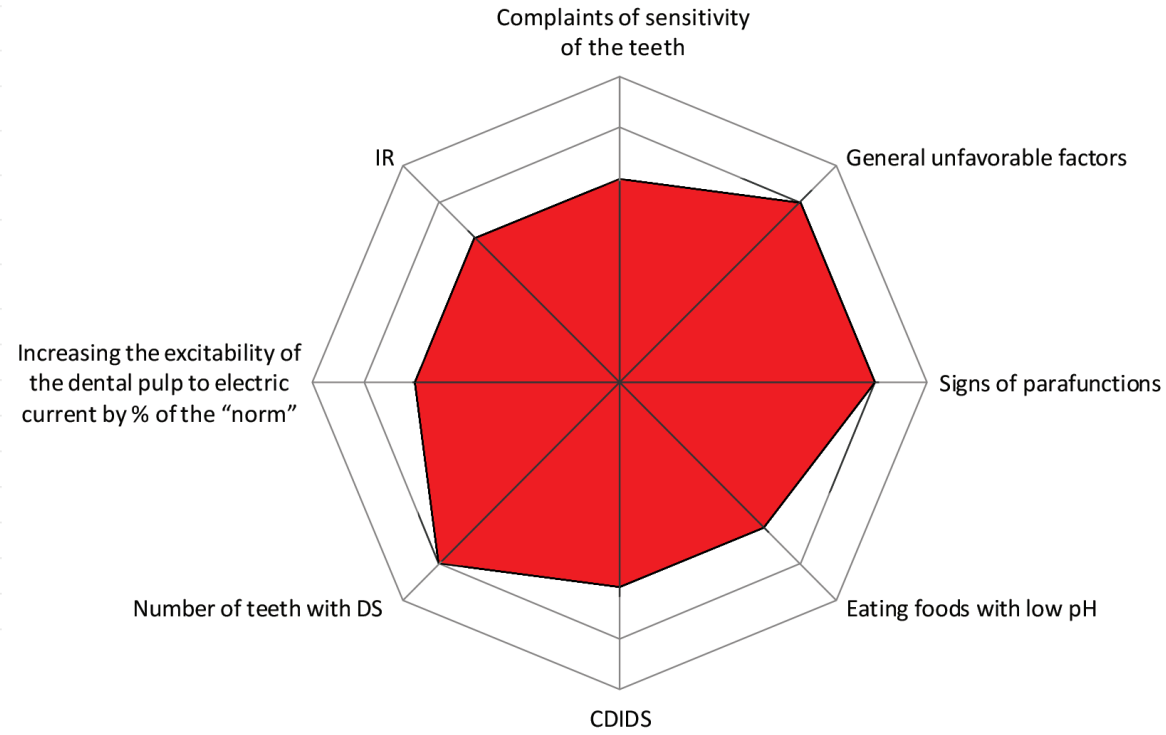
Level of risk of developing dentin sensitivity	Low
Follow-up interval	12 months
Area occupancy	3 %

Fig. 1. Patient Z., 42 years old. Low risk of developing DS: low risk of common diseases; 1 time per month eat foods with low pH; indicators CDDSI – 1.0; 2 teeth with DS; increasing the excitability of the dental pulp to electric current by 30 % of the norm; follow-up interval – 3 months; DSPI – compensated condition (16.7 %)



Level of risk of developing dentin sensitivity	Medium
Follow-up interval	6 months
Area occupancy	13 %

Fig. 2. Patient K., 43 years old. Medium risk of developing DS: high risk of development of common diseases; eating foods with low pH 1 time per month; indicators CDDSI – 2.5; 5 teeth with DS; increasing the excitability of the dental pulp to electric current by 45 % of the norm; follow-up interval – 6 months; DSPI – satisfactory condition (33.3 %)



Level of risk of developing dentin sensitivity	High
Follow-up interval	3 months
Area occupancy	53 %

Fig. 3. Patient I., 39 years old. High risk of developing DS: subcompensated course of atherosclerotic stenosis of the right carotid artery; daily consumption of foods with low pH; signs of "daytime" bruxism with complaints; indicators CDDSI – 5.0; 10 teeth with DS; increasing the excitability of the dental pulp to electric current by 70 % of the norm; follow-up interval – 3 month; DSPI – state of decompensation (83.3 %)

Conclusion

1. A new valid method has been developed for predicting the likelihood of developing DS in dental patients based on regression analysis of prognostic criteria (μ = 72–93 %), which made it possible to select targeted therapeutic and diagnostic measures and the frequency of individual follow-up with constant monitoring of prognostic criteria. This made it possible not only to clearly inform the patient about the level of risk of developing DS, but also to constantly monitor prognostic signs, which increases the effectiveness of treatment by 47 %.

2. Good treatment results in 97 % of cases in long-term follow-up determined the feasibility of including in the complex treatment of DS a developed program for predicting the development of DS with a clinical index for predicting dentin sensitivity in dental patients.

Conflict of interests. The authors declare no conflict of interests.

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