Dynamic follow-up of the patients with high caries intensity with the use of modern diagnostic technique

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Summary

The *aim* of this study was to stabilize caries process in patients with high caries intensity by improving the prevention and treatment efficiency on the basis of scientifically grounded dynamic follow-up with the use of modern diagnostic techniques.

Materials and methods. Two protocols of dynamic follow-up of patients with high caries intensity were used. The first protocol designed by the authors included modern diagnostic techniques and control visits every 3 months during the first year. Based on the first year results, the subjects (n = 87) were divided into groups A, B and C for further dynamic follow-up. The second protocol contained conventional diagnostic techniques and prevention/treatment plans; control visits of the patients (n = 45) were carried out every 6 months for 3 years.

Results. Having studied all data obtained during the dynamic follow-up we found close correlation between ERAI changes and caries development (r > 0.6); its good response to the treatment suggests that this technique should be used in the dynamic follow-up of patients with high caries intensity in each control visit. During 3 years of clinical trials, the suggested protocol increased enamel resistance indices by 55%, reduced dental plaque formation intensity by 77% and increased oral fluid pH by 35% in patients with high caries intensity.

Conclusion. Based on the data of the 3-year dynamic follow-up, we conclude that the suggested protocol has increased the efficiency of caries process diagnostics, of prevention and treatment procedures and resulted in caries stabilization in 95.5% of cases.

Keywords: caries process, patients with high caries intensity, diagnostic techniques, dynamic follow-up.

Introduction

The improvement of diagnostic efficiency is one of the most prospective targets in the medical science [1]. The problem of management of the patients with high caries intensity has not been solved yet [2,3]. It can be explained by the insufficiency of information provided by the existing diagnostic methods [4]. In practice dentists meet certain difficulties associated with the contradiction among different diagnostic techniques and the results obtained. The objective, subject and methods of the investigation have been defined on the basis of the data available and the practical results obtained.

The objective of the research was to stabilize caries development in patients with high caries intensity by improving prevention and treatment efficiency on the basis of scientifically grounded dynamic follow-up with the use of modern diagnostic techniques.

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Materials and methods

A comparative evaluation of the existing diagnostic techniques used in caries patients and the analysis of availability for practical health care as well as their repeatability, diagnostic and prognostic validity has been performed [5,6,7]. A new assessment method of dental enamel resistance to acid demineralizing impact of dental plaque has been developed (Eurasian Patent Organization, patent for invention, No. 007047/31.01.05). [8]

Two protocols .of dynamic follow-up of patients with high caries intensity were used.

The first protocol designed by the authors included modern diagnostic techniques and control visits of patients every 3 months during the first year. Based on the first year results the subjects were divided into A, B and C groups for further dynamic follow-up (instruction No. 3 of the Health Ministry of the Republic of Belarus, 25.04.05). [9]

The second protocol contained conventional diagnostic techniques and prevention/treatment plans and control visits of the patients were carried out every 6 months for 3 years.

The subjects of clinical trials were 153 patients (68 males and 85 females) aged 20-34 years (median age 27.1 ± 3.2). They were divided into groups.

Group No. 1 was formed by 87 (56.9 ± 5.3%) patients with high caries intensity. They were submitted to dynamic follow-up according to the first protocol.

Forty-five (29.4 ± 6.8%) patients with high caries intensity were included in Group No. 2 and the dynamic follow-up according to the second protocol was carried out.

The groups under study did not evidence significant differences in caries intensity level, age, sex and results of examination and questioning. All patients were healthy people.

Prevention and treatment procedures were performed in all the patients. They included professional oral hygiene, applying professional fluorides, cavity preparation and filling of decayed teeth. The patients were motivated to carry out caries preventing procedures. They were informed about the necessity of oral hygiene, reduction of carbohydrate intake frequency and usage of fluorides.

The control group was formed of 21 patients (13.7 ± 7.5%) free of dental caries whose findings of objective diagnostic techniques were within the norm.

In these patients the process of caries development was studied with the help of a designed complex including questioning the patients, clinical examination and the following objective indices:

- decayed, missing and filled teeth (DMFT) (WHO, 1987);

- caries intensity level (CIL) (Leous PA., 1990);

- intraoral radiography (Rabukhina N.A., 1998);

- enamel resistance to acid impact (ERAI) (Dedova L.N., Bandaryk E.A., 2005);

- enamel resistance test (ERT) (Okushko V.R., 1984);

- dental plaque examination:

• hygiene index (OHI-S) (Green-Vermillion, 1964);

• dental plaque formation intensity (DPFI) (Bandaryk E.A., 2004);

• plaque formation rate index (PFRI) (Per Axelsson, 1989);

• dental plaque pH (Dedova L.N., Bandaryk E.A., 2004);

- oral fluid examination:

• oral fluid pH (FDI, 2001);

• oral fluid viscosity (Leous P.A., Beliasova L.V., 1995);

• non-stimulated salivation rate (FDI, 2001);

• oral fluid microcrystallization (Leous PA., 1977);

• relative oral fluid viscidity;
• oral fluid biochemical
parameters
(including determination of activity
of
LDH, alpha-amylase. alkaline
phos-
phatase, acid phosphatase, whole pro
tein contents, glycoproteins,
calcium,
inorganic phosphorus);
- dietary habits investigation:
• diet diary (Leous P.A., 1997);
• fluoride concentration in the urine
(MarthalerT.M., Kolesnik A.G.,
1996).

Conventional assessment techniques of caries process were: questioning the patients, clinical examination and the following objective indices: DMFT. OH1-S, intraoral radiography (if administered).

Caries process was understood as a sum of interacting factors leading to progressive localized destruction of dental hard tissues and caries intensity increase in patients.

The assessment of dynamic follow-up efficiency was based on the number of patients with good, satisfactory and unsatisfactory result in each group. Absence of complaints, normal findings of objective diagnostic techniques, clinical absence of caries increase were considered to be a good result. A satisfactory result was characterized by absence of complaints, insignificant deviations in the objective findings, clinical absence of caries increase. An unsatisfactory result correlated with presence of complaints, significant deviations in the objective findings and clinical increase of caries intensity.

To systematize the results a special form for examination and a dynamic follow-up of patients was developed.

Statistic evaluation was performed by means of computer program Excel Statistics for Windows and methods of descriptive, inductive and correlative statistics.

Results and discussion

The methods chosen were characterized by high repeatability, diagnostic validity and availability for practical health care. Thus, it was determined that there is a correlation of caries intensity increase with ERAI ($r = 0.66$, $p < 0.01$); CIL ($r = 0.64$. $p < 0.01$); DPFI ($r = 0.69$, $p > 0.01$); pH-curve drop amplitude ($r - 0.60$, $p < 0.01$); duration of pH-curve restoration ($r = 0.59$, $p < 0.01$); saliva pH ($r = -0.46$, $p < 0.05$); saliva secretion rate at rest ($r = -0.38$, $p < 0.1$); type of oral fluid microcrystallization ($r = 0.49$. $p < 0.05$); oral fluid viscosity test ($r = 0.21$, $p < 0.1$); carbohydrate intake frequency ($r = 0.35$, $p < 0.1$).

At the same time, the immediate methods, which were the most valid and responsive to the treatment during the follow-up process, were chosen. They included CIL (caries intensity level), ERAI (enamel resistance to acid impact), DPFI (dental plaque formation intensity) and oral fluid pH. These methods were used with each control visit of the patients for objective assessment of caries process and prognosis of its dynamic changes. Such methods as assessment of oral fluid properties (non-stimulated salivation rate, viscosity test, oral fluid microcrystallization test), the method of determining daily carbohydrate intake frequency (diet diary), assessment of dental plaque pH curve after stimulation with 10% sucrose solution (indices: pH drop amplitude and duration of pH-curve restoration), as well as indices of 24-hours fluoride excretion with urine were used to specify immediate indices and to obtain additional information about caries process.

Primary objective examination of Group No. 1 revealed the following data: DMFT = 14.11 ± 4.15; CIL = 0.58 ± 0.18; ERAI = 1.57 ± 0.48; DPFI = 2.55 ± 0.87 ; oral fluid pH = 6.22 ± 0.25; non-stimulated salivation rate (NSSR) = 0.25 ± 0.07 ; vis-cositv test (VT) = 2.25 ± 0.98: oral fluid

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microcrystallization test (MT) = 2.08 ± 0.59; dental plaque pH drop amplitude (A) = 2.06 ± 0.27; duration of dental plaque pH restoration period Ta = 49.06 ± 4.75; 24-hours fluoride excretion with urine (FE) = 0.87 ± 0.21 (0.013 ± 0.003 mg/kg of body weight).

The objective diagnostic techniques indicating high level of caries process, prevention and treatment procedures were carried out. They included professional oral hygiene, topical fluoride application, cavity preparation and filling of decayed teeth. The patients were informed about individual caries preventive methods: oral hygiene, reduction of carbohydrate intake frequency and usage of fluorides.

In a 3-month period after the treatment 72.41% of patients showed good results. Satisfactory results were seen in 24.14% of cases. Unsatisfactory result was 3.45%. After 12 months of dynamic follow-up 68.92% of patients achieved good results, while satisfactory and unsatisfactory results were 25.68% and 5.4%, respectively (Table 1).

During the first year of the dynamic follow-up, caries development analysis was performed and the patients were divided into Groups A, B and C. A compensated condition of caries process was reported in 68.92% of patients (Group A with control visits twice a year). There were insignificant deviations in objective findings in 25.67% of patients. They were assigned to Group B with control visits 3 times a year. Significant deviations in objective findings were seen in 5.4% of patients. They were included in Group C, control visits being every 3 months.

During the second year of the dynamic follow-up the prevention/treatment plans were performed depending on the objective findings. By the end of the second year 88.3% of Group A patients had achieved good results. They were recommended to have their control visits twice a year. In Group B, good results had been seen in 78.2% of patients. They were transferred to Group A with control visits twice a year. In Group C, satisfactory results had been achieved in all the patients, they being transferred to Group **B.**

Table 1. Results of dynamic follow-up in Group No. 1 (modern diagnostic techniques and prevention/treatment procedures), M ± SD%

Result	Terms of control examination			
	3 months	6 months	9 months	12 months
Good	72.41 ±4.79	58.22 ± 5.55	65.33 ±	68.92
Satisfactory	24.14 ±4.58	35.45 ± 5.38	32.41 ±5.38	25.68 ±
Unsatisfactor	3.45 ± 1.96	6.33 ± 2.74	2.26 ± 1.72	5.4 ± 2.6

* p < 0.05

During the third year of dynamic follow-up, the patients in Group No. 1 received prevention and treatment procedures according to the objective findings. By the end of the third year good results were noted in 92% of patients included in Group A. They were recommended to have their control visits twice a year. In Group B, 88.8% of patients showed good results and were transferred to Group A, with control visits twice a year. Thus, during the whole period of dynamic follow-up good results were achieved in 95.5% of patients.

Patients included in Group No. 2 were applied conventional diagnostic and prevention/treatments procedures. The initial objective findings were: DMFT = 13.80 ± 4.29; OHI-S = 2.19 ± 0.69. Next control visit was carried out 6 months later after the performed treatment. Good results were

seen in 55.81% of cases, satisfactory and unsatisfactory results being reported in 27.91% and in 16.28%, respectively. After a 12-month follow-up, good results accounted for only 30.0% and satisfactory result was 25.0%. At the same time a significant increase in unsatisfactory results (45.0%) was observed (*Table 2*).

Table 2. Results of dynamic follow-up in Group No. 2 (conventional diagnostic techniques and prevention/treatment procedures), M ± SD%

Result	Terms of control examination	
	6 months	12 months
Good	55.81 ± 7.95	30.0 + 7.34 *
Satisfactory	27.91 ± 6.84	25.0 ± 6.93
Unsatisfactory	16.28 ± 5.91	45.0 ± 7.96 *

By the end of the second year good results were only 25.0%, satisfactory result accounting for 20.0%. Unsatisfactory results had increased up to 55.0%. The third year of follow-up having been completed, good, satisfactory and unsatisfactory result was 15.0%, 18.0% and 67.0% respectively.

Having studied all the data obtained during the dynamic follow-up we can state that a close correlation between ERAI changes, caries development (r > 0.6) as well as its good response to the treatment suggests that this technique should be used in the dynamic follow-up of the patients with high caries intensity in each control visit.

During 3 years of clinical trials it has been established that the suggested protocol of dynamic follow-up increased enamel resistance indices by 55%, reduced dental plaque formation intensity by 77% and increased oral fluid pH by 35% in patients with high caries intensity.

Conclusion

Based on the data of 3 years of dynamic follow-up of the patients with high caries intensity, we conclude that the suggested protocol has increased the efficiency of caries process diagnostics as well as that of prevention and treatment procedures and resulted in caries stabilization in 95.5% of cases.

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