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ORAL LIQUID CRYSTALLIZATION FEATURES OF SMOKERS

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Abstract

The multilateral study of physical and chemical properties of oral liquid is of prior importance for the study on peculiar features of pathogenesis and clinical manifestation of oral tissues diseases, in particular of periodontal pathology, especially under conditions of exposure to various harmful factors of tobacco smoke.

The aim of our research was the comparative study of morphological features of oral liquid crystallization of smokers and non-smokers.

Native oral fluid was collected from 20-30 years old men (n=120), on an empty stomach, between 9:00-9:30 a.m.

Men enrolled in this investigation were divided into two main groups:

- Group A - patients with gingivitis:
  - A1: smokers (34 persons)
  - A2: non-smokers (26 persons),
- Group B - healthy subjects:
  - B1: smokers (31 persons)
  - B2 non-smokers (29 persons).

Scanning electron microscopy examination of saliva samples were carried out using "VEGA TS 5130 MM" microscope (Czech Republic).

Data obtained in the study definitely indicates that there are clear differences in quantitative and qualitative characteristics of oral liquid crystal formation between smoking and nonsmoking individuals.

Keywords: oral liquid, smoking, crystallization.

INTRODUCTION

Self-assembly is a smooth process of aggregation, which often leads to formation of regular crystalline structures [*Poglazov B., 1970*]. All liquid media of an organism have the crystals making ability. According to E. Kalikinskaya, the crystal structures of the biological fluid in healthy and diseased individuals differ strongly [*Kalikinskaya E., 1999*]. This medium has difficult and remarkably symmetrical structure in healthy people, meanwhile in patients it is asymmetrical and fragmented structures can be detected. That is, a drop of biological liquid (blood, saliva, urine, intracerebral, cerebrospinal fluid) contains information about the state of the whole organism.

The tezigraphic method or method of native liquid investigation are frequently used to study the crystal structure of biological fluids. The principle of the first method is that the crystal-forming substance can change the normal course of crystals formation in the liquid. As crystal-forming substances copper or sodium chlorides are mainly used. For the next method, in case of solid phase of biological liquids investigation, the crystal-forming substance is not added and the process of crystal formation is going by its natural course. This method was suggested

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by V. Shabalin and S. Shatokhina [*Shabalin V., Shatokhina S., 1996; 2001*]. The authors called the method "wedge dehydration", which is based on the principle of self-organization in biological liquids.

The first notion on scientific and clinical significance of saliva and oral liquid crystallization we meet in works of P.A. Leus (1977). Subsequent years are mainly characterized by studies on morphological features of oral liquid at various diseases of organs and systems of the human organism [*Plaksina G. et al., 1998; Sambulov V. et al., 2001; Selifanova V. et al., 2005; Denisov A. et al. 2006*].

All physiological and pathological processes in the oral cavity occur in the permanent presence of oral liquid and therefore under its active influence. In turn, saliva (or oral liquid) is the first biological liquid that is exposed to tobacco smoke [*Didilescu A. et al., 2009*]. This signifies that comprehensive study of physical and chemical properties of this biological liquid is important for investigation of pathogenesis and clinical features of oral tissues diseases, in particular of periodontal pathology especially under the influence of various negative factors of tobacco smoke.

The aim of our research was the comparative study of morphological features of oral liquid crystallization in smokers and non-smokers.

MATERIAL AND METHODS

Native oral fluid was collected from 20-30 years old men (n=120), on an empty stomach, between 9:00-9:30 a.m.

Men under investigation were divided into two main groups: group A - patients with gingivitis (A1 smokers: 34 persons and A2 non-smokers: 26 persons), group B - healthy subjects (B1 smokers: 31 persons and B2 non-smokers: 29 persons).

A drop of oral liquid was dripped on the aluminum holder covered with silicium, and the sample was placed in a vacuum chamber of the microscope. Scanning electron microscopy examination of saliva samples was carried out using "VEGA TS 5130 MM" microscope (Czech Republic) at the Center of Electron Microscopy of the Institute of Physical Research.

RESULTS AND DISCUSSION

As a result of preliminary investigation, our research identified and described the following options for self-assembly of crystalline network of oral fluid (Table 1):

1. The complete absence of crystalline lattice. This structural variant of facies (dry trace of a drop) was observed in 16 cases (13.33%);
2. Crystal lattice is located in the peripheral zone of facies and the central part is relatively free from crystals. Similar ratio of crystal lattice and free zones was the most common and observed in 40 samples (33.33%);

Table 1.

The frequency of crystal formation different options
in patients with gingivitis and healthy subjects: smokers and non-smokers ,

Crystal lattice (option)	Group A (gingivitis)		Group B (healthy people)	
	A_1 smokers (n=34)	A_2 non-smokers (n=26)	B_1 smokers (n=31)	B_2 non-smokers (n=29)
1	0	3	4	9
2	7	11	10	12
3	2	6	6	5
4	7	4	3	2
5	1	2	4	1
6	5	0	2	0
7	6	0	1	0
8	6	0	1	0

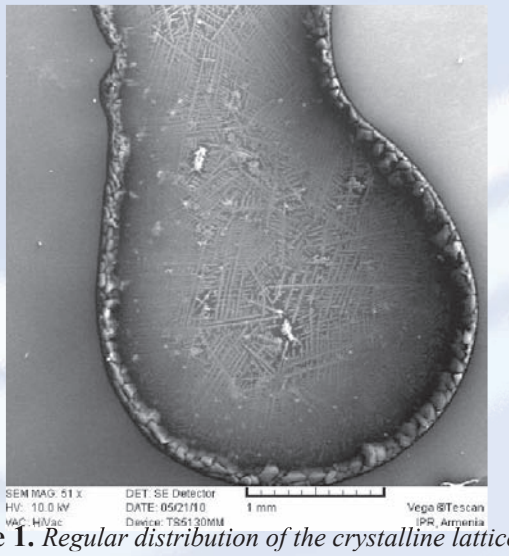

Figure 1. *Regular distribution of the crystalline lattice over the entire surface of the facies, with large crystals in the center (option 6).*

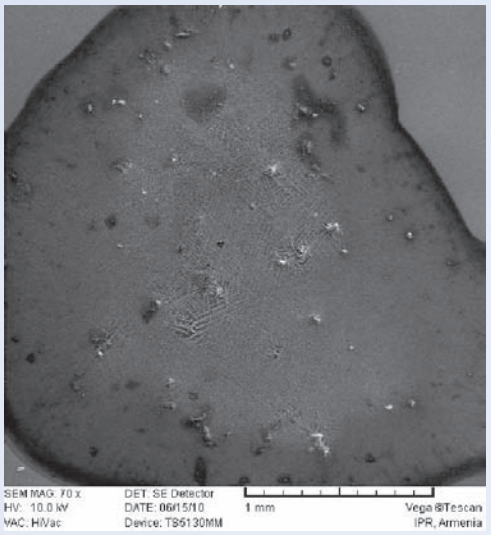

Figure 2. *Crystalline lattice is distributed in the form of separate islets (option 5)..*

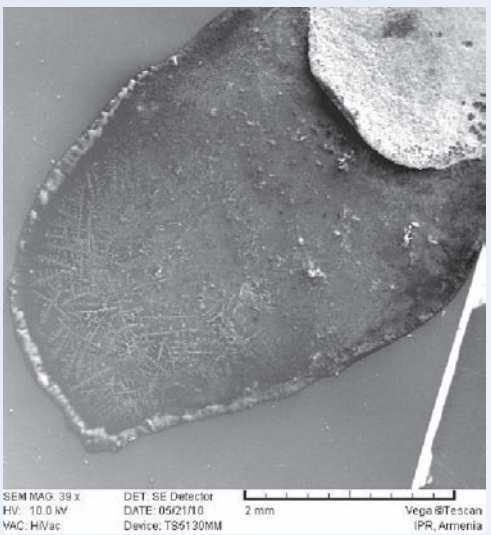

Figure 3. *The eccentric arrangement of the crystal lattice (option 8).*

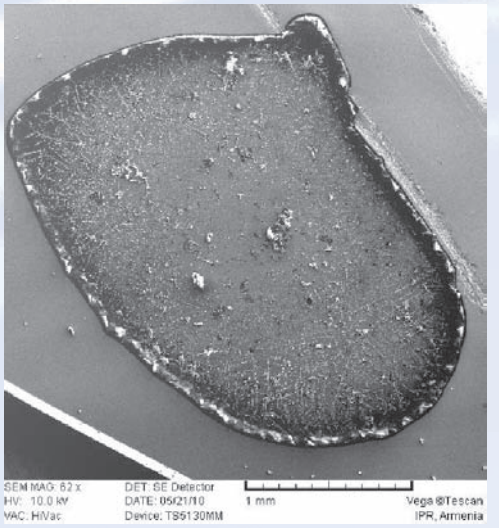

Figure 4. *Crystalline lattice is located in the peripheral zone of the facies (option 2).*

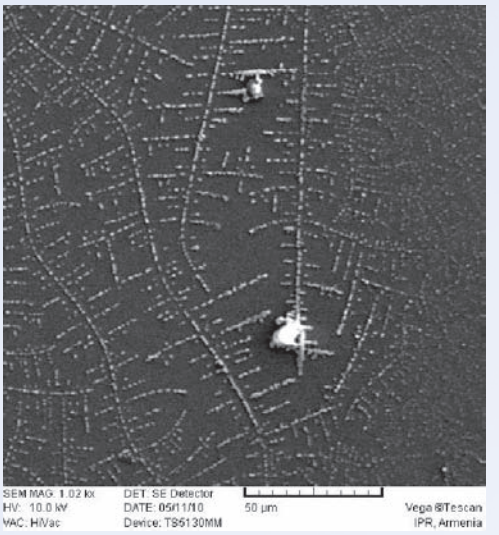

Figure 5. *Undulating course of crystalline rays.*

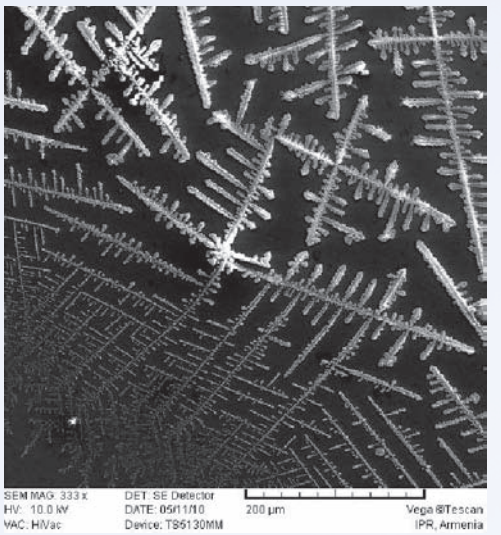

Figure 6. *Direct rays of the crystal.*

Table 2.

The average values of crystal formation in investigated groups and the difference between groups

Index	Group A (gingivitis)				Group B (healthy people)				$t_{A/B}$	$t_{A1/B1}$	$t_{A2/B2}$
average values of the crystallization	n=60	A_1(n=34)	A_2 (n=26)	$t_{A1/A2}$	n=60	B_1 (n=31)	B_2(n=29)	$t_{B1/B2}$			
	4.03 ±0.27	5.26 ±0.24	2.65 ±0.18	8.7	2.28 ±0.17	4.55 ±0.29	2.1 ±0.14	7.6	5.5	1.9	2.4

3. Crystal lattice is located in the central part of the facies, while the peripheral zone is free of such structural elements. This morphological variant of ratio in facies structural elements occurred in 19 cases (15.83%);
4. Irregular distribution of the crystalline lattice over the entire surface of the facies, with free zones both in the center and in the periphery. This variant was observed in 16 cases, which is 13.33 % of the total number of observations;
5. Crystalline lattice is located in the center of the facies in the form of separate islets and is characterized by weak signs of crystal formation. This variant occurred in 8 cases (6.67%);
6. The eccentric arrangement of the crystal lattice, i.e. part of the facies is completely devoid of crystalline structures, while in other part of the drop dense crystal lattice is observed. This version occurred in 7 cases (5.83%);
7. Regular distribution of the crystalline lattice over the entire area of the facies. The frequency of this variant was 7 (5.83%);
8. Another subspecies of the previous version was also identified. It was also characterized by uniform distribution of the crystalline lattice on the surface of facies, but in the central zone the crystals were defined more clearly and differed in relatively large spatial size. This option was noticed in 7 cases (5.83%).

It is noteworthy that in non-smokers (either in the healthy group and those with gingivitis), the sixth (Figure 1), fifth (Figure 2) and eighth (Figure 3) types of crystal formation were not observed. In turn, it is obvious that the first and second versions of oral liquid crystal lattice were prevalent in healthy non-smoking young people (Figure 4), and options 6, 7 and 8, respectively, were mainly found in smoking individuals with gingivitis.

Data of Table 2 evidence that there are significant differences in the type of crystal formation between the major groups. In particular, in the group of people with gingivitis the difference confidence factor among smokers and non-smokers was 8.7, whereas in healthy persons it made 7.6. This was observed despite the fact that in the same subgroups of individuals with gingivitis and healthy subjects this coefficient made either insignificant (1.9 in smokers) or marginal (2.4 in non-smokers) reliability value.

On conditions of periodontal pathology the crystal formation process of oral liquid is marked with irregular length of primary crystal rays: some rays have significant length, which is several times more than the length of primary rays, which are normally observed. Moreover, primary crystalline rays are also characterized by certain features in case of gum inflammation. These features are: a) an undulating course of primary ray is frequently revealed, and b) the amount of secondary crystalline rays exceed in number - an average of 14 pairs with short and long secondary rays alternating. Probably, these phenomena can also be explained by the significant length of primary rays. Apropos, an undulating course of rays is observed only in smokers with gingivitis (Figure 5), whereas in non-smokers crystalline rays appear as straight arrow (Figure 6). In addition, there are often thick rays (primary and secondary) at gingivitis; both the whole ray or only a part of it (mostly terminal part) can undergo such thickening.

Thereby, research findings definitely indicate that there are clear differences in quantitative and qualitative characteristics of oral liquid crystal formation between smoking and non-smoking individuals. Further detailed study of these features will allow to identify prognostic and diagnostic significance of this phenomenon.

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