

Article

Dynamics of Cytokine Concentration in the Wound Infiltrate of the Periodontal Pocket in the Treatment of Endodonto-periodontal Lesions

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Abstract: For the first time, the dynamics of the content of cytokines IL-1a and IL-1b at the stages of treatment of endodonto-periodontal lesions and in the long-term period was studied. The trend of concentration interleukin concentration dynamics for 6 months was evaluated. It was found that the inclusion of an ozone-air mixture in the complex treatment of endodonto-periodontal lesions can increase the effectiveness of treatment of a group of patients with this pathology, which is confirmed by clinical studies.

Keywords: endodonto-periodontal lesions, cytokines, ozone-air mixture..

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1. Introduction

The urgency of the problem of endodonto-periodontal lesions (EPL) is associated with the complexity of diagnosis and treatment of patients with combined periodontal pathology and complications of dental caries (pulpitis and periodontitis). Insufficient awareness of doctors about the features of these lesions and their complex treatment, along with weak interdisciplinary interaction between specialists of various specialties, explains the overall low effectiveness of treatment in this group of patients. Treatment of patients with EPL requires a one-time elimination of infection from the root canal system and periodontal pocket, and the relief of periodontal inflammation is more difficult [3]. Today, EPL is divided into two broad groups: periodontal lesions with secondary pulp involvement (PVE) and endodontic lesions with secondary periodontal involvement (EVP). The role of local non-specific protection factors in periodontitis (phagocytic cells, complement system, cytokines) was studied by G. M. Barer and T. I. Lemetskaya (1996) [1,2]. Many researchers believe that cytokine imbalance is the basis for the development of chronic inflammatory reactions, so it is cytokines that have a high diagnostic and prognostic value [4,5,6,8,9].

The cytokine IL-1 is the main proinflammatory cytokine that stimulates the proliferation and differentiation of various cell types. Two types of IL-1 are known: IL-1a and IL-1b. IL-1a is a mediator of short-acting action, located mainly inside the cell, upon destruction of which it is released. IL-1b is a secretory form that can act locally and systemically. Being an autostimulator, it plays a key role in triggering the cytokine pro-inflammatory cascade, supporting the inflammatory process and further destruction of alveolar bone tissue. [7,8].

The aim of this study was to assess the possibility of improving the effectiveness of EPP treatment with the inclusion of an ozone-air mixture in the complex of therapeutic measures based on the analysis of the dynamics of the content of cytokines IL-1a and IL-1b.

2. Materials and Methods

The material was collected from patients of the comparison group (20 people) and the observation group (20 people) using strips of sterile filter paper 10x4 mm in size, immersing them in the periodontal pocket for 1 minute (time was measured using an hourglass counted for 1 minute) (Fig. 1), then the paper was immersed in the periodontal pocket.





Figure 1. The extraction of wound exudate from the periodontal pocket with a strip of sterile filter paper.

An Eppendorf tube with a capacity of 1.5 mm containing 100 mcl of sterile saline solution, the volume of the solution was measured using an insulin syringe (Fig. 2). The extraction of wound exudate from the periodontal pocket was performed before treatment and 1, 3 and 6 months after treatment

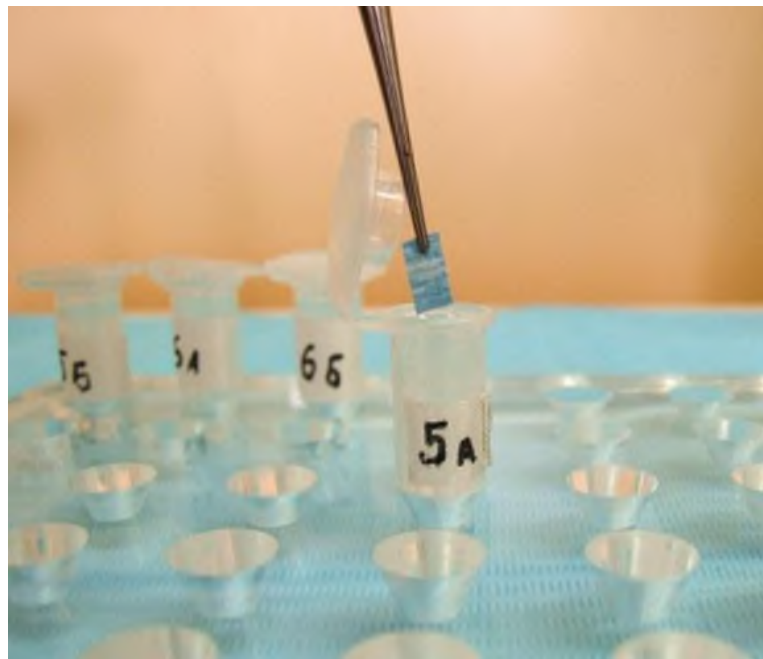


Figure 2. A strip of filter paper in an Eppendorf tube

The release of interleukins 1a and 1b was determined by enzyme immunoassay (ELISA). EIA is an immunological method for the determination of various compounds in biological fluids based on an antigen-antibody reaction. A solid—phase version of the EIA test was used, when one of the components of the immune response was absorbed on a solid carrier and commercial reagent kits Human IL-1beta Platinum ELISA and Human IL-1alfa Platinum ELISA (eBioscience, USA).

The results were recorded using a PR 3100 Bio Rad spectrophotometer (Bio-Rad Laboratories, USA), which measures the optical density of samples at a wavelength of 450 nm. According to the manufacturer, for IL-1a reagents, the sensitivity is 1.1 pg/ml, the range of the calibration curve



of the standards is 1.6–100 pg/ml; for IL-1b reagents, the sensitivity is 0.3 pg/ml, the range of the calibration curve of the standards is 3.9–250 pg/ml.

The results of the studies were processed by methods of variation statistics using the Microsoft Excel program, with an optimistically reliable analysis of the differences in indicators at the significance level $p < 0.05$.

3. Results

The average values concentration of IL-1b concentration in the wound exudate of the periodontal pocket are presented in Tables 1 and 2.

Table 1. Concentration of IL-1b in patients with EVP at the treatment stages

Group Terms	Average values (pg/ ml)	
	Comparison	Group
Pre-treatment	Follow-up group 108.5±38.64,64	117.4±23.7373
Student	t=-0.197, p=0.848	
1 month	28.26±14.28	76.76±33.81
Student	t=-1.322, p=0.216	
3 months	34.4±7.006	43.57±32.84
Student	t=0.273, p=0.79	
6 months	39.0±17.59	66.53±10.37
Student	t=1.348, p=0.207	

Note: The difference between the groups is not statistically significant, $p > 0.05$.

Table 2. Concentration of IL-1b in patients with PVE at the stages of treatment

Group Terms	Average values (pg/ ml)	
	Comparison	Group
Pre-treatment	Follow-up group 104.5±30.69	144.7±34.26
Student	t=-0.873.873, p=0.403403	
1 month	47.57±17.43	89.48±33.31
Student	t=-1.115, p=0.291	
3 months	69.53±30.55	73.65±19.63
Student	t=0.113, p=0.912	
6 months	87.07±36.18	96.7±34.39
Student	t=-0.193, p=0.851	
Student	t=1.348, p=0.207	

Note: The difference between the groups is not statistically significant, $p > 0.05$.

There were no statistically significant differences in the decrease in IL-1b concentration between the groups, which is most likely due to the small number of observations (EPP is a relatively rare pathology) as well as a significant variation in IL-1b concentrations before treatment. Within the group, there was a noticeable decrease in the concentration of interleukins at various times after treatment.

Since, due to the small number of observations on the concentration of IL-1b, the studied samples turned out to be unrepresentative, an assessment of the trend in the dynamics of interleukin concentrations over the entire observation period (6 months) was carried out. A decrease in their concentration by more than 33.3% was recognized as a positive sign characterizing a decrease in the inflammatory response in periodontal tissues. (Table 3)

Table 3. Trends in decreasing IL-1b concentration in the wound exudation of the periodontal pocket

	EVP	PVE
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time frame	Comparison Group	Monitoring Group	Comparison Group	Monitoring Group
0-6 months	36.6%	86.7%	20%	43.3%
Z-score	z=3.725, p=0.00		t=1.663, p=0.11	

The results of statistical processing using the Z-score showed that in patients with EVP lesions in the observation group, the concentration of IL-1b decreased significantly more intensively than in the comparison group. The intensity of the decrease in IL-1b concentration γ in patients with PVE lesions in the observation and comparison groups didn't significantly differ from each other, since PVE lesions, when the primary source of infection is the microflora of the periodontal pocket, are more severe and after treatment they have deeper periodontal pockets compared to the group of patients with EVP. Therefore, despite the clinical success of treatment, interleukin values indicate the presence of a more pronounced local immune response of eta to the biofilm microflora compared to the EVP group.

The method of data processing using the z criterion revealed that although the absolute values of the average concentration in the comparison group were lower than in the observation group, only two patients showed a decrease in concentration at all terms, while the rest showed abrupt changes both in the direction of decrease and increase. Thus, treatment in the observation group should be considered more effective.

When comparing the average values of IL-1a concentrations, statistically significant differences were obtained between the groups at 3 and 6 months in patients with EVP (Table 4).

Table 4. Concentration of IL-1a in patients with EVP at the stages of treatment

Group Terms	Average values (pg/ml)VP	
	Comparison	Monitoring
Pre-treatment	170.8±41.64	101.9±24.67
Student	t=-1.422, p=0.185	
1 month	104.1±19.31	51.35±23.33
Student	t=-1.742, p=0.112	
3 months	43.82±10.76*	10.15±2.687*
Student	t=-3.038, p=0.013	
6 months	14.33±3.89*	5.9±1.68 *
Student	t=-1.962, p=0.078	

Note: *The values are statistically significant.

The presence of a statistical model of overness already at the average level allowed us to abandon the analysis of trends for this interleukin.

Table 5. Concentration of IL-1a in patients with PVE during treatment stages

Group Terms	Average values (pg/ ml)	
	Comparison	Monitoring
Pre-treatment	62.8±27.69	72.95±25.59
Student	t=0.269, p=0.793	
1 month	48.05±25.06	30.83±9.436
Student	t=-0.643, p=0.535	
3 months	13.14±6.22	9.139±2.51
Student	t=-0.596, p=0.564	
6 months	5.33±3.259	2.11±0.12
Student	t=-0.989, p=0.346	

Note: * The difference between the groups is not statistically significant.

In patients with PVE lesions, statistical significance in the differences between the groups was not obtained.



4. Conclusion

As a result of evaluating the results of laboratory studies, it can be concluded that the inclusion of an ozone-air mixture in the complex treatment of endodonto-periodontal lesions can increase the effectiveness of treatment of patients with this pathology.

Application of artificial intelligence: The review is written without the use of artificial intelligence technologies.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Barer GM. Wound exudate of the periodontal pocket: composition and properties (review). *Dentistry*. 1986;4(86):86-90.
2. Barer GM, Lemetskaya TI. Periodontal diseases. Clinic, diagnosis and treatment. Training manual 1996.
3. Grudyanov AI, Moskalev KE, Makeeva MK, Byakova SF. Endodonto-periodontal lesions. Principles of diagnosis and treatment. *Endodontics*. 2010; 1-2:37-41.
4. Ivanyushko TP. The role of immunological mechanisms in the pathogenesis of periodontitis and justification of local immunotherapy methods: Avtoref. dis.. Doctor of Medical Sciences, 1979; 46 .
5. Kovalchuk LV, Gankovskaya LV, Rybakova ZI. The cytokine system. RSMU training manual. 2000; 64.
6. Prabhu A., Michalowe, Mathur A.: Defection of local and systemic cytokines in-adult periodontitis. *Journal of Periodontology*. 1996;69(3):363-366.
7. Kurihara H, Kobayashi Y, Francisco IA, Isoshima O, Nagai A, Murayama Y. A microbiological and immunological study of endodontic-periodontic lesions. *Journal of Endodontics*. 1995;(21):617-621.
8. Stashenko P, Obernesser MS, Prostalc L, Hoffajee AD, Socransky SS: Levels of interleikin 1-beta in tissue from sites of active periodontal disease. *Clinical Periodontology*. 1991;(18):548.
9. Talcahashi K, Takashiba S, Nagai A, Takigava M, Myoulcai F, Kurihara N, Murayama Y. Assessment of interleukin-6 in the pathogenesis of periodontal disease. *Journal of Periodontology*. 1994; 65(2):147-153.

