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Dynamics of Local Immunity of the Oral Cavity at the Stages of Treatment

Rizayev Jasur Alimdjanovich[1], Kunduzov Olimdjan Shakirdjanovich[2], Khazratov Alisher Isamiddinovich[3], Rajabiy Muzayyana Aziz Kizi[4]

[1,2,3,4]Samarkand state medical university, Uzbekistan

Abstract: Inflammatory periodontal diseases are associated with local and systemic increases in the levels of proinflammatory cytokines, such as tumor necrosis factor a, IL-6 and prostaglandins, and lead to tissue destruction through the participation of matrix metalloproteinases. Stress disrupts the balance between pro-inflammatory and anti-inflammatory responses. The article describes the dynamics of sIgA, salivary flow rate and sIgA concentration in saliva in teachers with chronic work stress against the background of complex treatment. 131 teachers of secondary schools and teachers of SamSMU with different periods of work experience took part in the study. Thus, based on the data presented above, we can conclude that measures to correct stress among teachers are recommended to be carried out every 6 months. This study presents new data on the immune functioning of the oral cavity in individuals with occupational stress among university and secondary school teachers. It demonstrates the relationship between perceived stress with salivary secretion and SIgA levels.

Keywords: Work Stress, Siga, Salivary Flow Rate, Periodontal Disease.

1. Introduction

Inflammatory periodontal diseases are associated with local and systemic increases in the levels of proinflammatory cytokines, such as tumor necrosis factor a, IL-6 and prostaglandins, and lead to tissue destruction through the participation of matrix metalloproteinases [3, 6]. Stress disrupts the balance between pro-inflammatory and anti-inflammatory responses. The relationship between stress and periodontal disease may be mediated by changes in the levels of IL-1, IL-6 in the gingival crevicular fluid, decreased chemotaxis and phagocytosis of polymorphonuclear leukocytes, and decreased lymphocyte proliferation [4].
Psychosocial stress stimulates the brain, where its stimulation or inhibition depends on adaptive and maladaptive coping, respectively. When the autonomic nervous system is stimulated, prostaglandins and proteases are secreted, which leads to the progression of periodontal diseases. Excessive production of glucocorticoids (cortisol) suppresses the immune system, reducing the secretion of IgA and IgG, thereby increasing the progression of periodontal disease and poor response to treatment [1]. Subsequently, this process can increase the vulnerability of periodontal tissues to pathogenic microorganisms due to the activation of cellular reactions leading to local tissue destruction [5].
Patients with periodontitis under stressful conditions have increased levels of IL-6 and IL-1, and similarly, patients with aggressive forms of periodontitis have increased levels of IL-6 and IL-1 in the blood serum [2].

2. Materials and Methods of Research.

131 teachers of secondary schools and teachers of SamSMU with different periods of work experience took part in the study.
After testing to identify signs of stress (PSM-25), the specialists were divided into subgroups:

1. Group A1 (SamSMU teachers without signs of stress, 27 people, 90 [69-113] points), age 37.15±3.4;
2. Group A2 (SamSMU teachers with a moderate level of stress, 24 people, 140.5 [102-157] points), age 38.01±2.9;
3. Group B1 (school teachers without signs of stress, 28 people, 87.5 [75-112] points), age 37.68±4.9;
4. Group B2 (school teachers with a moderate level of stress, 26 people, 133.5 [108-153] points), age 38.23±2.2.

Subgroups A1 and B1 were included in Group 1, subgroups A2 and B2 were included in Group 2.
A control group 3 (26 people), age 38.43±3.2, was organized from persons without periodontal diseases and signs of stress.

Determination of the concentration of SIgA in saliva and the rate of SIgA secretion and salivation rate.

To avoid any physiological factors that might influence salivary flow rate and SIgA secretion rate, samples were collected at the same time and on the same day of the week between 10:00 and 12:00. Samples were taken at rest, during classes. Whole, unstimulated saliva samples were collected after people rinsed their mouths with water twice. Participants were asked to spit any saliva they produced within 5 minutes into sterile tubes. Saliva samples were centrifuged at 12,000 rpm for 10 min, and then the supernatants were stored at −20°C until analysis. Salivary flow rate was determined in ml of saliva released per minute (ml/min).
Salivary SIgA concentrations were determined using microtiter plates and a Eurofins Technologies test system according to the manufacturer's instructions. After coating with primary antibodies and blocking the plates, saliva samples were diluted 1:1000 and incubated for one hour at room temperature. After washing, the plates were incubated with IgA peroxidase-conjugated antibodies. To determine the concentration of SIgA in saliva (μg/ml), absorbance values at 450 nm were plotted against a standard curve obtained from serial dilutions of a known concentration of purified human IgA. The rate of SIgA secretion from saliva was expressed as the amount of SIgA secreted per minute (μg/min).

3. Research Results

The improvement in the condition of the oral cavity is also evidenced by data on local immunity and saliva parameters (Table 1).

Table 1 Changes in the state of factors of local immunity of the oral cavity

Observation period	Group 1						Group 2					
	A1			B1			A2			B2		
	Salivation rate (ml.mi	SIgA concentration (μg.ml-1)	SIgA secretion rate (μg.min	Salivation rate (ml.mi	SIgA concentration (μg.ml-	SIgA secretion rate (μg.mi	Salivation rate (ml.mi	SIgA concentration (μg.ml-	SIgA secretion rate (μg.min	Salivation rate (ml.mi	SIgA concentration (μg.ml-	SIgA secretion rate (μg.min
Before treatment	0.54±0.02	216.34±191.27	85.72±28.27	0.57±0.01	196.45 ±181.43	67.34±23.02	0.59±0.33	195.47±181.41	69.52±22.11	0.62±0.47	203.04 ±186.73	77.42±52.07
After treatment	0.62±0.01	230.29±186.23	94.4±27.6	0.63±0.03	202.3±179.27	72.3±24.11	0.74±0.32	210.3±176.43	73.4±24.23	0.71±0.43	206.3±191.21	79.2±53.09
1 month after treatment	0.64±0.02	241.19±190.12	93.8±27.8	0.67±0.01	205.6±181.2	74.5±23.57	0.73±0.33	215.2±178.23	76.2±23.12	0.70±0.37	216.8±189.47	82.4±54.1
In 6 months after treatme	0.52±0.02	201.13±179.23	84.5±27.1	0.56±0.02	194.2±178.53	70.1±22.56	0.67±0.32	206.6±183.21	71.7±24.11	0.64±0.42	210.3±190.32	78.3±52.16
In 12 months after treatme	0.49±0.01	197.14±178.53	81.2±28.3	0.54±0.01	190.2±179.1	66.7±25.31	0.65±0.29	204.1±184.12	69.4±24.15	0.58±0.43	205.4±193.42	72.4±53.24

Evaluation of the immediate results of stress correction showed the high effectiveness of the improved treatment in Group 2. Thus, in Group 2, namely in the A2 and B2 subgroups, the rate of salivation also increased after therapy to 0.74 ± 0.32 and 0.71 ± 0, 43 ml/min versus 0.59±0.33 and 0.62±0.47 ml/min ($p<0.001$). After treatment, this indicator began to worsen and after a month it was 0.73±0.33 (in the A2 subgroup) and 0.70±0.37 ml/min (in the B2 subgroup), and after 6 months it decreased to 0.67± 0.32 and 0.64±0.42 ml/min, respectively. After 12 months, the salivary flow rate was 0.65±0.29 and 0.58±0.43 ml/min in subgroups A2 and B2, respectively. In A1 and B1 subgroups, the salivary flow rate increased to 0.62±0.01 ml/min and 0.63±0.03 ml/min against the initial 0.54±0.02 and 0.57±0.01 ml/min , respectively ($p<0.001$). One month after the therapy, the numerical value of the indicator was stable and amounted to 0.64±0.02 and 0.67±0.01 ml/min in the A1 and B1 subgroups, respectively ($p>0.05$). After 6 months, the rate of salivation began to decrease and was equal to 0.52±0.02 in the

A1 subgroup and 0.56±0.02 ml/min in the B1 subgroup, and after 12 months - 0.49±0.01 and 0.54 ±0.01 ml/min, respectively.
In A1 and B1 subgroups, the concentration of sIgA increased to 230.29±186.23 µg/ml and 202.3±179.27 µg/ml against the initial 216.34±191.27 and 196.45±181.43 µg/ml , respectively ($p<0.001$). One month after the therapy, the numerical value of the indicator was stable and amounted to 241.19±190.12 and 205.6±181.2 µg/ml in the A1 and B1 subgroups, respectively ($p>0.05$). After 6 months, the concentration of sIgA began to decrease and amounted to 201.13 ± 179.23 in the A1 subgroup and 194.2 ± 178.53 µg/ml in the B1 subgroup, and after 12 months - 197.14 ± 178.53 and 190.2 ±179.1 µg/ml, respectively.
In Group 2, namely in the A2 and B2 subgroups, the concentration of sIgA also increased after therapy to 210.3 ± 176.43 and 206.3 ± 191.21 µg/ml versus 195.47 ± 181.41 and 203.04 ±186.73 µg/ml ($p<0.001$). After treatment, this indicator began to improve and after a month it was 215.2±178.23 (in the A2 subgroup) and 216.8±189.47 mcg/ml (in the B2 subgroup), and after 6 months it decreased to 206.6± 183.21 and 210.3±190.32 µg/ml, respectively. After 12 months, the concentration of sIgA was 204.1±184.12 and 205.4±193.42 µg/ml in the A2 and B2 subgroups, respectively.
In A1 and B1 subgroups, the rate of sIgA secretion increased to 94.4±27.6 µg/min and 72.3±24.11 µg/min against the initial 85.72±28.27 and 67.34±23.02 µg/min min, respectively ($p<0.001$). One month after the therapy, the numerical value of the indicator was stable and amounted to 93.8±27.8 and 74.5±23.57 mcg/min in the A1 and B1 subgroups, respectively ($p>0.05$). After 6 months, the rate of sIgA secretion began to decrease and was equal to 84.5 ± 27.1 in the A1 subgroup and 70.1 ± 22.56 µg/min in the B1 subgroup, and after 12 months - 81.2 ± 28.3 and 66. 7±25.31 µg/min, respectively.
In Group 2, namely in the A2 and B2 subgroups, the rate of sIgA secretion also increased after therapy to 73.4±24.23 and 79.2±53.09 mcg/min versus 69.52±22.11 and 77. 42±52.07 mcg/min ($p<0.001$). After treatment, this indicator began to improve and after a month it was 76.2±23.12 (in the A2 subgroup) and 82.4±54.1 mcg/min (in the B2 subgroup), and after 6 months it decreased to 71.7± 24.11 and 78.3±52.16 µg/min, respectively. After 12 months, the sIgA secretion rate was 69.4±24.15 and 72.4±53.24 µg/min in the A2 and B2 subgroups, respectively.

4. Conclusions

Thus, based on the data presented above, we can conclude that measures to correct stress among teachers are recommended to be carried out every 6 months.
This study presents new data on the immune functioning of the oral cavity in individuals with occupational stress among university and secondary school teachers. It demonstrates the relationship between perceived stress with salivary secretion and SIgA levels.

5. References

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