

Comparative Assessment of the Cytokine Profile in Dynamics in Patients with Orthopedic Constructions from Different Construction Materials

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ABSTRACT

The state of the factors of local immunity of the oral cavity in the oral fluid before and after prosthetic structures with the use of fixed structures made of cermet and zirconium materials was studied in 180 people aged 20-70 years and 30 practically healthy people in the comparison group of the same age. The oral fluid determined and referred to the levels of proinflammatory cytokines IL-1 β , IL-6, FNO- α and anti-inflammatory cytokine IL-10. It was well established and (straight) depending on the state of immune homeostasis (cytokine status) oral mucosa of material orthodontic second structure.

KEY WORDS: homeostasis, oral fluid, interleukins, tumor necrosis factor, orthopedic

INTRODUCTION

More than 70% of the population of our Republic at the age of 20-60 has a violation of the integrity of the dentition and the need for orthopedic dental treatment. According to the WHO currently up to 75% of the population in various regions of the world suffer from partial absence of teeth [3, 12]. Defects in the dentition are a widespread pathology of the dental alveolar system; the need for orthopedic treatment with prostheses is 33–58% [6].

The problem of the relationship between the tissues of the oral cavity and various prosthetic structures and materials is the main one in the clinic of orthopedic dentistry, therefore, much attention is paid to it, both in domestic and foreign literature [7, 12, 13].

Metal-ceramic prostheses are structures that represent a frame, the base of which is made of metal, the upper coating is made of ceramics. Today, metal-ceramic prosthetics are the most demanded among patients. This is due to the many advantages that metal-ceramic structures have [8, 13].

Orthopedic zirconium constructions are made of zirconium dioxide. For prosthetics, not a pure mineral is used, but a material with additives of yttrium and aluminum. Due to the natural properties of the base material and additives, dental zirconium is highly resistant to various external factors and mechanical stresses. An important quality is the hypoallergenicity of zirconium, which means that dental prostheses made of this material are absolutely harmless and can be used to restore teeth and in people with individual intolerance to metals [2, 5, 12].

The biological compatibility of a denture is determined by its effect on the surrounding tissues and physiological processes in the oral cavity, and is determined by a number of factors: mechanical (the design

of the prosthesis), chemical (the release of residual toxic monomer), physical (hyperthermia), biological, etc. All of them cause pathological changes in periodontal tissues. Pathology of the mucous membrane under the prosthesis may be the result of an imbalance between the mechanisms of aggression and defense [7].

In modern studies, the leading role of cytokines in the development of the inflammatory response of the oral cavity during adaptation to prostheses that initiate a local immune response is also shown [4, 10].

Recent studies prove that the content of cytokines in saliva does not correlate with their level in the blood, which indicates a certain autonomy of the local immunity of the oral cavity and at the same time reflects the general tendencies of the cytokine cascade in the patient's body. This corresponds to the idea that salivary criteria reflect not only local, but also general disorders of homeostasis [1].

According to the above, the purpose of this study was to substantiate the choice of material for orthopedic structures based on a comparative assessment of cytokine status indicators characterizing the state of immune homeostasis of the oral mucosa (OOM) after prosthetics.

MATERIALS AND METHODS

Immunological studies were carried out in the laboratory of immunoregulation of the Institute of Immunology and Human Genomics of the Academy of Sciences of the Republic of Uzbekistan. The study involved 180 patients (115 women and 65 men), aged 20 to 70 years old. The average age of women was 38 years old, men - 49 years old. The patients were conditionally divided into two groups:

1st group - 180 patients (115 women and 65 men) who underwent metal-ceramic prosthetics;

Group 2 - 30 healthy patients (17 women and 13 men) who underwent zirconium prosthetics.

The control was the data of a survey of 30 apparently healthy volunteers, comparable in age and sex.

Measurement of concentration of IL-1 β , IL-6, IL-10, TNF α in oral liquid (GC), was conducted by enzyme immunoassay (ELISA) using commercial kits A.O. "Vector-Best".

Gastrointestinal tract sampling was performed before complex treatment in patients with defects in dentition and hard dental tissues and after prosthetics, not earlier than after 30 days, as well as in healthy individuals. To do this, at the dental appointment, the patient was asked to rinse the oral cavity with 3 small volumes of plain water and think about lemon to stimulate salivation. Sterile penicillin vials with a volume of 10 ml were used as test tubes, which patients filled with their gastric cancer up to 1/3-

1/2 of the total volume. The glass vials with the test material were frozen in a freezer and stored at minus 20°C for no more than one month. Thereafter, undiluted samples were thawed very quickly by heat treatment in a water bath at 37°C to prevent fibrinogen precipitation.

The data were statistically processed using the Statistics 6.0 computer program. The reliability of differences in the mean values of the compared indicators was assessed by the Student's test (t).

RESULTS AND DISCUSSION

The development of inflammatory diseases is determined by the state of cytokine regulation. Most of both pro- and anti-

inflammatory cytokines are present not only in the peripheral blood, but also in other biological fluids of the body [9]. The sources of their production are both lymphocytes and macrophages built into the epithelium of the mucous membranes, and the epithelial cells of the mucous membranes and the salivary glands themselves. Another source of cytokines in gastric cancer (saliva) may be their extravasation from blood serum.

m. However, many researchers have noted that the content of cytokines in gastric cancer (saliva) does not correlate with their level in the blood, which indirectly indicates their local synthesis [11].

According to holding mu analysis in a GC patients and of healthy individuals were identified significant differences in the content of the test of pro-inflammatory IL-1 β , IL-6, FNO- α and anti-IL-10 cytokines (Table.1).

Table 1. The level of pro-and anti-inflammatory cytokines in the oral fluid of patients studied before beginning prosthetic (M $\pm$ m, pg/ml)

	n	IL-1 β	IL-6	TNF- α	IL-10
Main (general) group	180	7.5 $\pm$ 0.20*	14.7 $\pm$ 0.46*	12.3 $\pm$ 0.32*	10.6 $\pm$ 0.32*
Control group	thirty	4.2 $\pm$ 0.26	11.8 $\pm$ 0.55	9.4 $\pm$ 0.39	8.5 $\pm$ 0.38

Note: *Values are reliable in relation to the data of the control group ($P < 0.05-0.001$)

Analysis of the data set that the content of IL-1 β to treat patients was about in the middle 7.5 $\pm$ 0.20 pg/ml, then like the comparison group, its concentration was 4.2 $\pm$ 0.26 pg/ml ($P < 0.001$). The concentration of IL-6 in the general group of patients before the start of orthopedic treatment exceeded the values of the control group by more than 1.3 times (14.7 $\pm$ 0.46 pg/ml versus 11.8 $\pm$ 0.55, pg/ml, $P < 0.001$), which indicates an already formed inflammatory focus in the oral cavity.

As a rule, the content of FNO- α is not determined, or is at a low level in the blood serum of healthy people, whereas with the development of a pathological process, its amount increases several times. Thus, synthesis of FNO- α in patients with the group to prosthetic averaged 12.3 $\pm$ 0.32 pg/ml, and these values were in the control group 9.4 $\pm$ 0.39 pg/ml, which is 1.3 times more ($P < 0.001$). It was also found that a significant increase in the level of IL-10 in the main observation group before orthodontic treatment was 1.2 times (10.6 $\pm$ 0.32 pg/ml versus 8.5 $\pm$ 0.38 pg/ml) ($P < 0.001$).

The obtained data with cytokine status of the oral cavity before the prosthetics point to the weakening of the local immune defense GPRS, connectivity with the need for orthopedic intervention.

After the imposition of dentures, the 1st dental examination was carried out the next day, at the stage of denture correction. Treatment of inflammatory changes in the mucous membrane was carried out both at the reception and at home using preparations containing antiseptic, anesthetic, regenerating components in accordance with the "Protocol for the management of patients with partial absence of teeth (partial secondary adentia)".

Thus, in the I-group Ceramic prostheses after 7 days, 83% (72) patients complained of pain in the oral mucosa during interdiction and upon application of the denture. Examination revealed inflammatory changes in the mucous membrane of the prosthetic bed, which were represented by hyperemia and erosion, localized in the region of the border of the denture, as well as in areas of increased base pressure on the mucous membrane. At the repeated stages of the denture correction, the patients showed no complaints, no inflammatory changes were found on the oral mucosa.

The study of the content of cytokines showed that in patients with reddening of the mucous membrane, the area of which coincided with the shape of the edge of the metal-

ceramic denture, already on the 7th day, a cytokine imbalance was noted in the oral fluid, characterized by a significant increase in the content of IL-1 β , IL-6, IL-10, and FNO- α (Fig. 1).

Comparative analysis of the content revealed that in group I with metal-ceramic prosthetics, the level of IL-1 β increased by 3 times after a week with an average value of 22.7 ± 0.35 pg/ml (before treatment, 7.5 ± 0.20 pg/ml) ($P < 0.001$), the concentration of IL-6 increased to 42.9 ± 1.07 pg/ml (before treatment 14.7 ± 0.46 pg/ml) ($P < 0.001$), TNF- α 37.2 ± 0.76 pg/ml (before treatment 12.3 ± 0.32 pg/ml) ($P < 0.001$), IL-10 21.5 ± 0.55 pg/ml (before treatment 10.6 ± 0.32 pg/ml) ($P < 0.001$) (Fig. 1).

The cytokine profile of oral mucosa after a week in patients of group II with zirconium prostheses significantly differed from the group with metal-ceramic prosthetics. When examining the oral cavity in 91% (84) of patients with zirconium prosthetics already after 7 days, the tight fit of the zirconium prostheses to the tissues of the oral cavity excluded subsidence of the gums, exposure of the dental root, and inflammation of the soft tissues of the oral cavity (Fig. 2).

So the content of IL-1 β after a week in group II averaged about 19.4 ± 0.61 pg/ml ($P < 0.001$), the concentration of FNO- α significantly reached a peak after 7 days 28.5 ± 1.04 pg/ml ($P < 0.001$), the content after 7 days was 34.2 ± 0.62 pg/ml ($P < 0.001$), in patients after the installation of an orthopedic construction, the level of IL-10 increased on average to 16.7 ± 0.57 pg/ml after 7 days ($P < 0.001$) (Fig. 2).

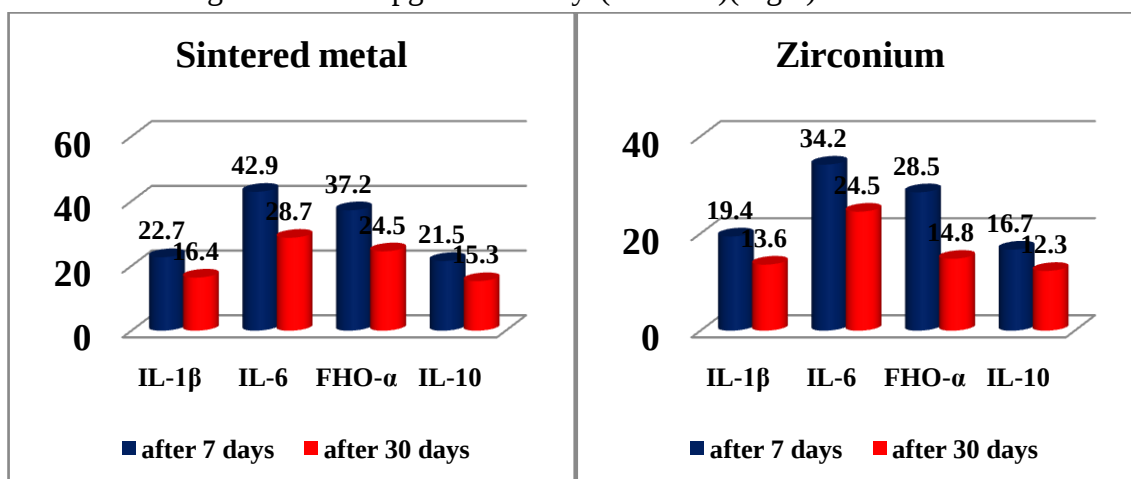


Fig.1 The content of cytokines in the gastric cancer after prosthetics after 7 and 30 days in patients with metal-ceramic prostheses

Fig.2. Content of cytokines in gastric cancer after prosthetics after 7 and 30 days in patients with zirconium prostheses

The study of the dynamics of the above mentioned mediators of inflammation recorded a decrease in the expression with 30 days after fixation of the fixed bridge, but these data did not reach the values before the start of treatment and did not undergo significant fluctuations in the future, that is, remained within the specified concentrations.

Thus, in group I of patients with metal-ceramic prosthetics after 1 month, the level of IL-1 β decreased to 16.4 ± 0.74 pg/ml ($P < 0.001$), IL-6 to 28.7 ± 0.72 pg/ml ($P < 0.001$), TNF- α 24.5 ± 1.03 pg/ml ($P < 0.001$), IL-10 15.3 ± 0.65 pg/ml ($P < 0.001$) (Fig. 1).

It is important to note that in the II group of patients with zirconium prosthetics, the level of IL-1 β after a month of prosthetic implantation retained a tendency to decrease by 30% compared to the values after 7 days. Thus, the content of IL-1 β after 30 days is 13.6 ± 0.46 pg/ml ($P < 0.001$) (Fig. 2.)

Concentration of FNO-

α was significantly decreased on Day 30 to 14.8 ± 0.36 pg/ml, but did not reach the initial values (starting- 12.3 ± 0.32 pg/ml ($P < 0.05$)). The rating of content via 1 month established as light decrease in the expression of IL-6 to 24.5 ± 1.03 pg/ml ($P < 0.001$). A decline after 1 month was observed in the level of IL-10, which averaged 12.5 ± 0.68 pg/ml ($P < 0.001$) (Fig. 2.)

These indicators indicate a decrease in the inflammatory response of the oral cavity, albeit slow, but stabilization of the local immunemood of the oral cavity.

There revealed significant increase in the concentration of pro-inflammatory cytokines IL-6 and TNF- α after 7 days and 1 month in both groups indicates a significant decrease in anti-infectious resistance in the oral cavity, which is a consequence of an imbalance between the normal flora and the body's immune response at the local level.

Thus, on the basis of the studies carried out, it can be stated that the established cytokine imbalance in gastric cancer group I with metal-ceramic prosthetics indicates an increase in the antigenic load and an increase in the permeability of the oral mucosa as a result of a traumatic genesis of the prosthetic bed and, as a consequence of the developed inflammatory process, which causes discomfort.

Comparative analysis of the obtained data of group II with zirconium prosthetics revealed a positive dynamic of indices of local immunity linking gastric cancer in patients of this group. On examination, no foci of inflammation caused by the prostheses were observed, which indicates a satisfactory regeneration of the tissues of the prosthetic bed, and according to the patients, they were completely adapted to the denture.

The obtained data of the comparative analysis make it possible to develop an algorithm for the treatment of the consequences of metal-ceramic and zirconium prostheses, in the use of orthopedic structures made of various materials.

CONCLUSION

1. The activation of the inflammatory process in the periodontal tissues was established, manifested by an increase in the concentration of pro- and anti-inflammatory cytokines already on the 7th day after fixation of the prosthetic structure.

2. It was revealed that with zirconium prosthetics, the positive dynamics of indices of local immunity linking gastric cancer in patients of this group. On examination, no foci of inflammation caused by the prostheses were observed, which indicates a satisfactory regeneration of the tissues of the prosthetic bed, and in the patients' opinion, they were completely adapted to the denture.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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