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Dynamics of restoration of microcirculation of the peri-implant zone in the area of dental implants during early functional loads.

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Introduction:

At present, a wealth of experience has been accumulated in the use of intraosseous implants in the orthopedic treatment of patients with a partial or complete defect in the dentition. Original designs of dental prostheses based on dental implants have been developed, the main indications and contraindications for their use have been determined, and the methodology for their introduction and subsequent prosthetics has been worked out [1,6]. A favorable outcome of orthopedic treatment using various implant systems is determined by many factors, among which the most significant is the function6al state of the tissues of the prosthetic bed [3,4]. The impact of dentures on the tissues of the prosthetic field, as well as on the body as a whole, is diverse. It is determined, on the one hand, by the nature, intensity and duration of exposure to the stimulus (prosthetic prosthesis), on the other hand, by the state and reaction of the tissues of the prosthetic bed [1,2]. The results of orthopedic treatment of patients depend mainly on the functional state and reactive properties of the supporting tissues, as well as the nature of the distribution of the masticatory load on the supporting structures. In this regard, the issue of studying the relationship between hemodynamic processes in the area of implants and the effect of masticatory loads after prosthetics remains relevant.

The purpose of this work: is to study the effect of early functional chewing loads on the hemodynamic processes of peri-implant tissues.

Keywords: intraosseous implants, orthopedic treatment, microcirculation, blood flow, chewing.

Materials and research methods.

For the study, 2 groups of patients aged 25 to 45 years were selected, among them 18 women and 15 men. The 1st group included 13 patients in whom the studies were carried out after the installation of intraosseous dental implants, the 2nd group included 20 patients who were fitted with implant-supported bridges. In both groups of patients, one- and two-sided end defects of the dentition were observed. Dynamic observations of the hemodynamic parameters of peri-implant tissues were performed by laser Doppler flowmetry (LDF) using a capillary blood flow analyzer LAKK-01 (NPP Lazma). Dynamic observations of the state of microcirculation in the gum tissues were carried out in the implant area before prosthetics and 2 weeks, 1 month, 3 and 6 months after the fixation of bridges.

Results and their discussion.

Analysis of the results of LDF in patients of the 1st group revealed a certain regularity in the dynamic state of microcirculation in peri-implant tissues, depending on the timing of observations.

1 month after implantation, the hyperemia subsided, as a result of which the microcirculation indicators improved significantly, but were lower than the initial values, which indicated the persistence of venous congestion in the tissues of the mucous membrane of the alveolar process in the area of implantation. Although the levels of rhythmic components of tissue blood flow in the frequency spectrum of LDF-grams decreased by 41–82%, they were lower than the initial level and characterized the presence of venous congestion in the microvasculature of the peri-implant tissues. Vasodilation of microvessels was replaced by vasoconstriction, the tonic tension of the vascular wall increased by 75%, which reflexively reduced arterial inflow in conditions of venous stasis (Fig. No. 1).

3 months after implantation, congestion in the microvasculature subsided, as evidenced by an increase in the intensity of blood flow and vasomotor activity of microvessels by 57% and 59%, respectively, their values exceeded the initial data, which characterized an increase in blood circulation. The level of rhythmic components of LDF-grams increased by 6–16% and, most significantly, pulsed fluxmotions increased (by 52%), which indicated an increase in blood flow in the arteriolar and venular parts of the microvasculature. At the same time, vasoconstriction weakened, intravascular resistance decreased, which indicated an improvement in the patency of microvessels. The efficiency of the functioning of microcirculation decreased by 12%, which characterized the preservation of tension in the mechanisms of regulation of tissue blood flow under conditions of bone tissue restructuring.

6 months after implantation, the obtained trend of microcirculatory parameters persisted, indicating an improvement in microcirculation.

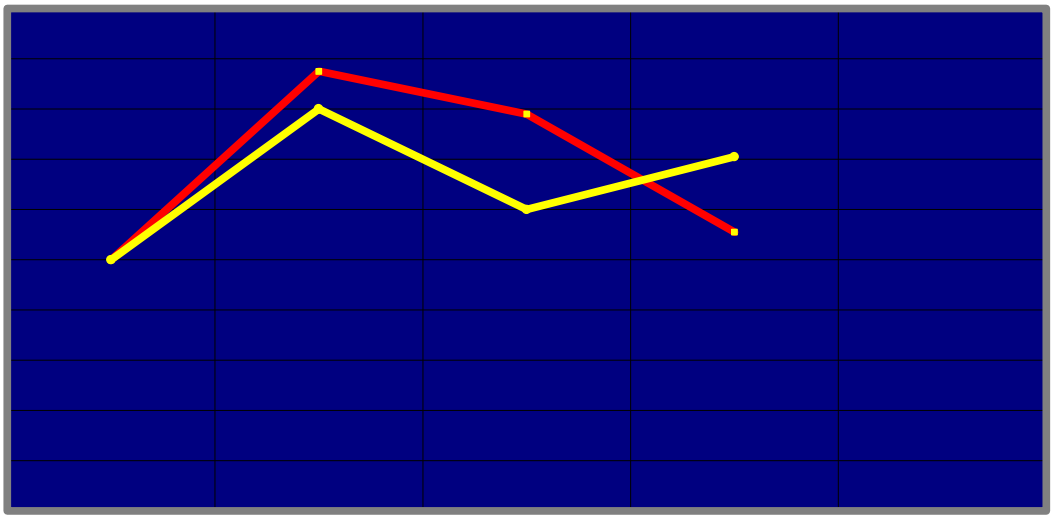

Fig. No. 1 Dynamics of the level of capillary blood flow after implantation (M) in the gum tissues (initial values of M were taken as 100%).

Red line - early functional loads; yellow line - no load.

Studies of the state of microcirculation of peri-implant tissues after the installation of implants in patients of the 2nd group revealed the following regularity in the dynamics of microcirculation parameters.

According to the LDF data, 1 day after implant insertion with immediate loading, the level of capillary blood flow increased by 75%, which indicated an increase in tissue perfusion in the implant area with blood. Blood flow activity (σ) increased by almost 2.5 times, vasomotor activity of microvessels (Kv) - by 40%, which indicated the development of hyperemia in the microcirculatory bed in response to traumatic intervention in the jaw bone tissue (Fig. No. 3).

After 3 months, in the tissues surrounding the implants, the level of capillary blood flow (M) decreased by 17%, remaining still quite high relative to the initial value. The intensity of microcirculation fell by 31% relative to the initial value. Vasomotor activity (Kv) decreased by 2.5 times compared with the preoperative period, which indicated the relief of the phenomenon of hyperemia.

6 months after exposure to chewing loads, all analyzed microcirculation parameters were restored to their original values. The level of tissue blood flow (M) decreased by 17%, its intensity (σ) increased by 13%, vasomotor activity of microvessels increased by 12%, which indicated the restoration of microcirculation in the tissues surrounding the implant.

After 12 months of functioning of dental implants, which were introduced into function immediately after their installation in the alveolar bone, the level of tissue blood flow (M), its intensity (σ), and vasomotor activity of microvessels (Kv) tended to further improve, which indicated the normalization of hemomicrocirculation in the tissues surrounding the implants (Fig. No. 2).

In the frequency spectrum of Dopplerograms, there was a violation of the ratio of the rhythmic components of tissue blood flow, which was expressed in an increase in the contribution of vasomotions (ALF/□) to the rhythmic structure of fluxmotions by 26% and indicated an increase in the active modulation of tissue blood flow. At the same time, high-frequency (AHF/□) and pulse (ACF/□) fluctuations increased by 25% and 62%, respectively, characterizing the development of hyperemia in the microvasculature. Vascular tone increased by 29%, intravascular resistance increased significantly (by 2 times), which indicated a difficult outflow of blood. Due to hemodynamic disturbances, the efficiency of microcirculation decreased (by 14%).

A comparative analysis of hemodynamic parameters in patients of both groups revealed a restoration of the ratio of rhythmic components in LDF-grams, which indicated a normal passage of blood in the microcirculatory bed. Vascular tone decreased (by 18%) to the initial level. The efficiency of the functioning of the microcirculation corresponded to the initial data, which indicated the stabilization of

tissue blood flow. After prosthetics on single implants, in response to their functional load, after 1 week in the gum tissues, there was an increase in capillary blood flow (by 36%), its intensity by 25%, and vasomotor activity of microvessels (by 2.1 times), which characterized the development of hyperemia in the microcirculatory system. channel.

Thus, the hemodynamic parameters of peri-implant tissues demonstrate a pronounced adaptive response from the microvascular bed to an early functional load. Based on the hemodynamic parameters of peri-implant tissues obtained in the 2nd group of patients, one can reliably state the activation of the intensity of hemodynamic processes in the tissues around the implants due to the impact of functional masticatory loads.

Findings.

1. The dynamics of regional hemodynamic parameters indicates adaptation to an early functional load, and complete restoration of regional blood circulation in the implantation zone by 6 months. observations.

2. With an early functional load on the implant, the level of tissue blood flow, its intensity and vasomotor activity of microvessels increase by 40–75%, which indicates the development of hyperemia in the microvasculature, which stops after 3 months. Restoration of microcirculation occurs 6 months after dental implantation.

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