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# IMPROVEMENT OF PERIODONTAL TREATMENT METHODS IN PATIENTS WITH DENTAL IMPLANTS

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**ABSTRACT** — In connection with the increase in the number of dental implants installed, there is an increase in the number of inflammatory processes — mucositis and peri-implantitis, which rank first among the complications after dental implantation. Our study confirmed the high clinical effectiveness of the GBT protocol combined with the use of a brush for reciprocating rotation with pulsation in the complex of supportive periodontal therapy. Hence, we can recommend this complex not only for patients at risk (with a history of inflammatory periodontal diseases), but also for other patients with dental implants. This protocol of maintenance therapy is a simple and cost-effective way to prevent inflammatory complications after dental implantation.

**KEYWORDS** — periodontal diseases, dental implants, Guided Biofilm Therapy (GBT) protocol.

## INTRODUCTION

Today, dental implantation is widely used all over the world to replace missing teeth. In this regard, there is an increase in the number of cases of inflammation of the surrounding tissues — mucositis and peri-implantitis. The frequency of inflammatory complications ranges from 54–77% — mucositis and peri-implantitis — 16–22% [1,2,3].

It has been proven that the main etiological factor in the occurrence of inflammatory complications in the area of implants — mucositis and peri-implantitis — is a biofilm [6, 7, 8, 9]. Studies have shown a significant correlation between poor oral hygiene and peri-implantitis [10, 11], and the role of existing periodontitis as a risk factor for mucositis and peri-implantitis is also noted [12, 13]. Those implants placed in patients with a history of periodontitis are associated with a higher incidence of biological complications and lower rates of success and engraftment than in periodontically healthy patients. High rates of implant loss are associated with severe forms of periodontal disease

[14]. Biofilm-related infections are known to be resistant to antimicrobial therapy [15] if the biofilm is not mechanically disrupted [16].

Due to the peculiarities of the implant surface and limited access to the biofilm, surgical access may be required more often and at an earlier stage in the treatment of peri-implantitis than in periodontal therapy [10]. Thus, intervention in biofilm formation is a universal measure for the prevention of oral diseases [17].

Since inflammatory complications not only lead to destruction of bone tissue around implants and the risk of their loss, but also have a negative effect on general health, supportive peri-implant therapy (SPIT) should be an integral part of implant treatment [4]. To ensure a favorable long-term result of implantation, it is necessary to take all measures for the prevention and timely treatment of mucositis and peri-implantitis [5].

The basic principle of operation of a hygiene product — a toothbrush, the regularity and correctness of its use can affect the results of individual oral hygiene and the prevention of caries and periodontal diseases [18, 19, 20, 21], there are few data in the literature on the influence of the method of individual oral hygiene in patients with dental implants at risk for the result of maintenance therapy.

*Purpose:*

to improve the methods of peri-implant therapy for dental implantation.

## MATERIALS AND METHODS

85 patients with supportive periodontal therapy (SPT) aged 24 to 52 years with concomitant initial and moderate (mild to moderate) generalized periodontitis in remission were under observation (see Table: Classification of periodontal diseases and conditions and peri-implant tissues, 2018) [22, 23], in equal proportions formed the study group, which underwent dental implantation according to a two-stage protocol (153 implants), within 1, 3, 6 months after the installation of the orthopedic constructions.

Depending on the method of individual oral hygiene and the protocol of professional oral hygiene, the patients were divided into three groups. SPIT patients of the first group (I, n = 30) and the third (III, n = 25)

group were carried out according to the Guided Biofilm Therapy (GBT) protocol aimed at controlling biofilm, which is of great importance in patients at risk — with periodontitis, including stages in the following sequence (Fig. 1):

(Fig. 1e) with erythritol powder (Air-Flow Master Piezon, Air-Flow Plus powder, 14  $\mu\text{m}$ , EMS) [24],

5. Hardware ultrasonic method for removing mineralized dental plaque (Air-Flow Master Piezon, EMS), instrument PS in the area of teeth, PI instru-



Fig. 1 (a, b, c, d, e, f, g, h, i). Stages of professional hygiene of oral cavity according to the Biofilm Guided Therapy

1. examination, diagnosis (Fig. 1a);  
2. indication of biofilm of different maturity with a three-tone dye (GC TriPlaque ID Gel) (Fig. 1b),

Fig. 1 (a, b, c, d, e, f, g, h, i). Stages of professional oral hygiene according to the Guided Biofilm Therapy protocol.

Fig. 1 (a, b, c, d, e, f, g, h, i). Stages of professional hygiene of oral cavity according to the Biofilm Guided Therapy.

3. motivation of the patient, training in rational oral hygiene with the correction of manual hygiene skills and the selection of individual hygiene products, taking into account the identified zones of presence of mature biofilm;

4. air polishing to remove biofilm sub- and supragingivally (Fig. 1c, d), from the oral mucosa

in the area of implants with maximum irrigation flow aimed at the visualized areas after removing biofilm (Fig. 1f)

6. quality control of professional oral hygiene (Fig. 1g),

7. rational individual hygiene and supportive therapy through individually set periods with hygiene control (Fig. 1h — control after a week, Fig. 1i — after a month).

Patients of the second (II,  $n = 30$ ) group underwent professional oral hygiene according to the *classical* protocol — diagnosis, removal of mineralized deposits by ultrasound, biofilms above the gums — air polishing with sodium bicarbonate powder (Air-Flow Classic, EMS, 65  $\mu\text{m}$ ), under gum and in the area of implants — glycine (Air-Flow Plerio, EMS, 23  $\mu\text{m}$ ) [25].

All patients were recommended (prescribed): methods of interdental hygiene (brushing and flossing), an irrigator. In group I, patients cleaned their teeth with a manual toothbrush, the rest — with an electric one: in group II — a brush brush for reciprocating rotation (7600 rotation movements per minute) (Oral-B Vitality), in group III — a brush with reciprocating rotary pulsating movements (up to 10,500 reciprocating-rotational and up to 48,000 pulsating movements per minute) and Bluetooth for feedback and optimization of the efficiency of the teeth cleaning process through a mobile application by processing data received from the front camera of a smartphone during the procedure (Oral-B Genius). The movements of the brush for reciprocating rotation with pulsation determine its effect on the biofilm: the pulsating movements destroy, and the reciprocating movements remove it from the surface of the teeth and orthopedic structures. In the application, individual settings were entered for patients with an increase in the recommended cleaning time in the area of implants, and the application also generates a reminder to the patient about the need for hygiene procedures, monitors their compliance (including interdental hygiene with the use of additional means), encourages for correct implementation, gives comments, reference data, records the collected information, generates a statistical report on the quality of the patient's personal hygiene and sends it to the doctor's (assistant's, administrator's) e-mail.

The effectiveness of SPIT was assessed based on the analysis of clinical parameters (objective examination) and indicators of periodontal and hygienic indices: the index of quantitative determination of plaque in the gingival area Silness-Loe (SL), the index of plaque interdental spaces API, the index of bleeding PBI (papilla bleeding index) (Muhlemann -Sukser), PMA index, subjective pain sensations were recorded according to the visual analogue scale (VAS), the timing of the manipulations performed according to each of the protocols was carried out, the patients were questioned twice.

## RESEARCH RESULTS

Indicators of hygienic and periodontal indices before hygiene measures were: S-L — in group I  $1.8 \pm 0.1$ ; in II —  $1.7 \pm 0.1$ ; in III —  $1.8 \pm 0.1$ ; API — 40, 38 and 43%; PBI —  $1.3 \pm 0.3$ ;  $1.2 \pm 0.1$ ;  $1.3 \pm 0.1$ ; PMA  $13.7 \pm 1.2$ ;  $13.2 \pm 1.3$ ;  $15.6 \pm 1.1$  in groups I, II and III, respectively. After professional oral hygiene, motivation and correction of hygiene skills in the second visit (after 3 months), varying degrees of improvement were recorded in most patients.

With approximately the same initial data in group II, on average, there was no negative dynamics,

in groups I and III — positive dynamics in hygiene indices and periodontal indices during the entire observation period, with a statistically significant superiority in group III. Thus, the reduction of the index of gingival plaque S-L in group III after 3 months was 3 times higher ( $p < 0.01$ ) than in group I, 5.5 times ( $p < 0.01$ ) than in group II; the API index is 1.6 times ( $p < 0.05$ ) higher than in group I, 1.9 times higher than in group II ( $p < 0.01$ ). The dynamics of periodontal indices was noted in direct correlation with changes in the level of hygiene indices (Fig. 2a).

Fig.2 (a, b). Dynamics of hygienic and periodontal indices after 3 and 6 months from the initial level, %.

Fig. 2 (a, b). Dynamics of hygienic and periodontal indices in 3 and 6 months from the initial level, %.

After 6 months, against the background of professional hygiene within the SPIT and hygiene recommendations, an even more pronounced difference in hygienic and periodontal status was observed in the study groups: and to the data obtained after 3 months, then in group II they remained stable compared to the level after 3 months or even returned to the initial value (Fig. 3b).

The timing showed a lower time spent on professional oral hygiene according to the Guided Biofilm Therapy protocol (in patients of groups I and III) by an average of  $14.3 \pm 5.6\%$  ( $p < 0.05$ ) at a visit after 3 months and by  $21, 1 \pm 7.8\%$  ( $p < 0.01$ ) after 6 months than in group II. The assessment of subjective pain sensations during the SPIT procedure according to VAS showed in the GBT group 2.8 ( $p < 0.01$ ) and 3.4 times ( $p < 0.01$ ) (first and second procedures) lower Pictures compared to the group, where professional hygiene was carried out according to the classical scheme. When answering the questionnaires, more than 80% of respondents from groups I and III (GBT) noted the visualization of biofilm on the surface of teeth during staining as an important motivating factor for hygiene; increased sensitivity of teeth after professional hygiene in these groups was noted 3.3 times less patients than in group II. 96% of patients in group III indicated an increase in responsibility for observing individual oral hygiene, noting the analogy of reports sent by a mobile application with a doctor's constant monitoring of compliance with prescriptions.

Thus, without the indication and visualization of biofilm and the patient's motivation to correct the existing shortcomings in individual hygiene, the use of an electric toothbrush (group II — the classic PGPR protocol, Oral-B Vitality brush) did not give any advantages over group I (GBT protocol, manual brush).

The use of the GBT protocol showed better clinical results in both groups (I and III) in comparison

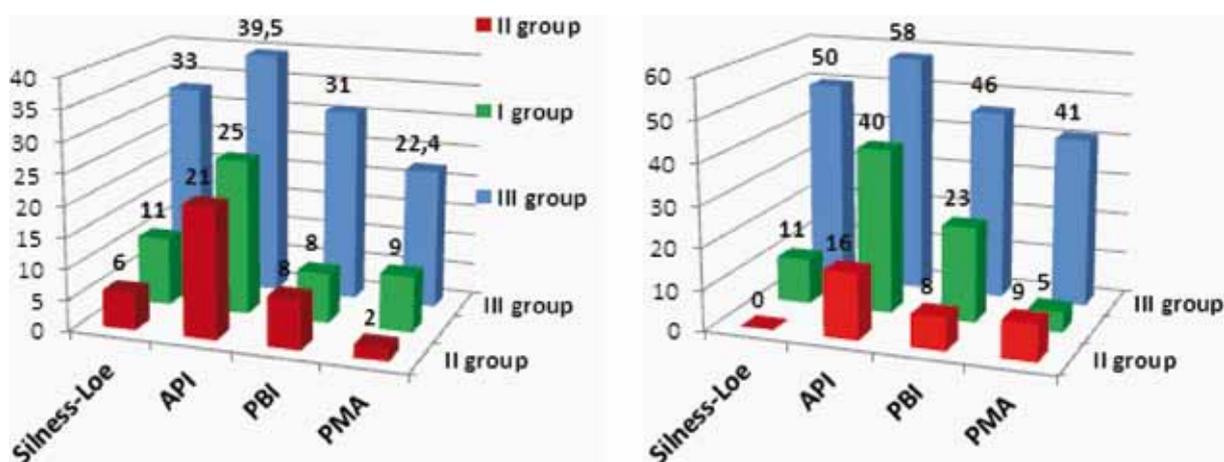


Fig. 2 (a,b). Dynamics of hygienic and periodontal indices in 3 and 6 months from the initial level, %

with the group with the classical protocol; in addition, a decrease in the doctor's time for carrying out a maintenance procedure was recorded on average by 18.3%. The absence of unpleasant sensations during the procedure and the phenomena of hyperesthesia after it in these groups make it possible to count on a large proportion of patients *return* to supportive therapy and adherence to its terms.

## CONCLUSION

The study showed both the high clinical effectiveness of the combined inclusion of the GBT protocol and the use of a brush with the technology of reciprocating rotational movements with pulsation and feedback through a mobile application in a complex of maintenance periodontal therapy, which statistically significantly surpasses the control group according to the index score, and economic efficiency and allows recommend this complex not only for patients at risk (with a history of inflammatory periodontal disease), but also for other patients with dental implants.

Biofilm control through clinically validated personal hygiene and Guided Biofilm Therapy as part of maintenance therapy is a simple and cost-effective way to prevent inflammatory complications after dental implantation and to ensure long-term stable performance of implant-supported prostheses.

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