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Long Term Outcomes of Implant Treatment in Patients with a History of Moderate Periodontitis and With Type 2 Diabetes Mellitus

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ABSTRACT

Purpose: *The aim of this study was to evaluate the long-term outcome of implant treatment in patients with previous tooth loss due to a history of moderate periodontitis and with type 2 diabetes mellitus.*

Materials and methods: *The study included 42 patients with partially edentulous, with a history of moderate periodontitis and with type 2 diabetes mellitus using 134 dental implants over the period from 2021 to 2023. At the baseline and at 3 month intervals bleeding on probing (BOP), probing depth (PD), marginal bone loss (MBL) were recorded. All patients prior implant surgery periodontal therapy were treated, which included the following: supragingival and subgingival scaling and root debridement were performed with an ultrasonic device, magnetic laser irradiation, local use of antibacterial agents.*

Results: *Implant surgery was performed 3 months after periodontal therapy, when PPD <4 mm and BOP <10%, with stable clinical index. After 12-month in patients mean MBL 0.76±0.6 mm, after 5 years MBL was 1.34 ± 0.25 mm (P> 05), after 10 years MBL was 1.56 ± 0.28 mm (P> 05). Survival rate of implants 5 years after was 96.4% implants 10 years after was 93.6%.*

Conclusions: *This study confirmed that implant therapy can be successfully used in patients diagnosed with moderate periodontitis and with type 2 diabetes mellitus who have received individualization supportive periodontal therapy, regular periodontal maintenance and if their HbA1c level was <7.2% or less than 154 mg/dL.*

Keywords

Periodontitis, Dental implant, Prosthodontic, Type 2 diabetes mellitus.

Introduction

Periodontitis is a very common disease, characterized by the defeat of the periodontal tissues resulting in the further loss of teeth. Periodontitis, the most common form of periodontal disease, reaches its peak at the age of 30–45 years [1].

Periodontitis is characterized by periods of exacerbation of inflammation of the periodontal tissues with subsequent periods of remission [2]. Microbial colonization on the surface of the tooth and in the gingival sulcus plays an important role in the etiology and development of periodontitis; among them, Prevotella intermedia, Tannerella forsythia, Porphyromonas gingivalis, Aggregatibacter actinomycetemcomitans, Bacterioides forsythus, Treponema denticola, Prevotella nigrescens, Peptostreptococcus micros, Fusobacterium nucleatum [3,4].

In the etiology of periodontitis, an important role is also played by poor oral hygiene, alcohol and tobacco use and genetic factors [5]. Of the systemic diseases, the risk of periodontitis is high in patients with cardiovascular diseases, renal failure, osteoporosis and diabetes mellitus [6,7].

In periodontitis, microbes colonizing in the tooth biofilm and in the gingival pocket release by- products leading to the host's immunomodulatory responses. These toxic products activate some cytokines, pro-inflammatory mediators and macrophages, under the influence of which the periodontal tissues are destruction, which subsequently leads to the loss of teeth [8].

In the 2018 World Workshop of the European Federation of Periodontology (EFP) and the American Academy of Periodontology (AAP), a new classification of periodontal and peri- implant diseases was adopted [9].

People with type 2 diabetes delayed wound healing, impaired response to infection, impaired bone metabolism. Patients with diabetes are often affected by periodontal disease and tooth loss, requiring advanced dental rehabilitation for these patients. Treatment of periodontal diseases has undergone a series of changes, over the past 20 years. Various treatment options are available periodontit including non-surgical therapy (scaling**,** root planning, antibiotics), surgical tissue engineering, photodynamic therapy etc [10]. A variety of systemic and local antibiotics and antimicrobial products are used of treatment disease.Surgical treatments including (periodontal surgery, soft and bone tissue grafts, stimulating tissue proteins). The choice of the method of prosthetic rehabilitation in patients with periodontitis and partially edentulous is very important.

Introduction to clinical practice dental implants reveal new possibilities in the treatment and rehabilitation of patients with periodontitis. Now dental implantat rehabilitation is the most advanced method of repairing dental defects in partially edentulous patients [11,12].

Inflammatory diseases of the periodontit and type 2 diabetes delayed wound healing are the relative contraindication for dental implants, the inflammation in the tissue of the periodontium inevitably leads to peri-implantitis [13]. Since one of the most important factors is periodontal factors periodontal condition must be evaluated and taken into account before embarking on implant treatment. Patients with periodontitis and with type 2 diabetes delayed wound healing are at high risk of peri-implantitis [14-16]. In different studies, the similarity of the composition of bacteria was found in patients with periodontitis and peri-implantitis [17,18].

Systematic literature reviews provide conflicting results on the effectiveness of dental implantation in patients with a history of periodontitis [19]. According to various literature data, periodontitis increases the loss of bone mass around the dental implant, which ultimately leads to the loss of the implant [20-27]. In their study, Leonhardt et al. found that in patients with partially edentulous and periodontitis, periodontal pathogens migrate to the peri-implant tissues [28]. Wang et al. in their studies found that periodontitis adversely affects the condition of the implant in the patient [29]. According to various authors, in patients with periodontal disease with 10-year follow-up, the implant survival rates range from 79% to 96.7% [30-32]. The aim of this study was to evaluate the survival rate of implants in patients with a history of moderate periodontitis with type 2 diabetes and partially edentulous.

Materials and Methods

In the present retrospective study, analyzed the results of treatment in 42 patients in the period from 2021 to 2023 years with partially edentulous and history of periodontitis with type 2 diabetes. All patients (18 men and 24 women, aged 36 to 63 years) presented functional and esthetic complaints. The diagnosis of periodontitis was established taking radiological signs of bone loss and indicators of bleeding on probing (BOP)>15%, probing depth (PD) with ≥ 5 mm, less than 15% marginal bone loss (MBL) in two or more teeth. Periodontal indices were measured before periodontal therapy, after 1 and 3 months of treatment.

In a clinical study took into account: the localization of the defect, the presence of an inflammatory process. Clinical, laboratory and computed tomography methods were used to plan implant therapy (Figures 1 and 2).

Figure 1: Intraoral view patients with a history of periodontal disease According to the 2018 standard, severe periodontitis (Stage IV) before treatment.

Figure 2: Preoperative OPG showing periodontitis lesions.

In all patients before implant surgery carried out complex periodontal therapy, removal of hopeless teeth and treatment of affected teeth. Complex periodontal treatment included: supragingival and subgingival scaling and root debridement were performed with an ultrasonic device, magnetic laser therapy for 7 days with a wavelength of 810 nm and a density of 100 mW during 5 min. Local use of antibacterial agents amoxicillin or clindamycin and postoperatively chlorhexidine mouth wash was prescribed twice daily. For, oral hygiene instructions included teeth brushing using soft dental brush two times daily. Implant surgery was performed after periodontal therapy and stabilization of periodontal indices, HbA1c level was <7.2% or less than 154 mg/dL according to the manufacturer's guidelines, using 134 various dental implants and procedures. One day after implant surgery, the patients received magnetic laser therapy for 7 days for 3 minutes. Patients are advised to rinse their mouth with 0.12% chlorhexidine solution for 2-3 weeks.

To assess the stability of the implants, the method of resonance frequency analysis (RFA) was used with the Osstell Mentor instrument during implant placement, after 3-5 months. Dental prosthetics began 3-5 months after the healing period using implant fixed dental prosthesis, X- ray was taken after fixation of the restoration (Figures 3-5).

Figure 3: Intraoral view of 8 abutments on the lower jaw before prosthetic rehabilitation.

Figure 4: Intraoral view after implant prosthetic rehabilitation.

Figure 5: OPG after implants prosthetic rehabilitation.

Prosthetics were performed with ISQ values above > 65 ISQ. To assess the success of oral implant rehabilitation, the success of the implant was studied; complications; implant survival, loss of men peri-implant marginal bone loss (MBL), prosthetic success. The patients were under observation, at every recall examination during the 10-year follow-up period, all evident biological complications and treated according to the implant treatment protocol. Change in marginal bone levels was assessed by taking x-rays after restoration fixation, after 1,3,5,10 years post operatively. The distances in millimeters between the shoulder of the implant and the first clear bone-to-implant contact mesially and distally were calculated.

Statistical Analysis

Statistical analyzes were performed using SPSS (SPSS Software, USA). The p values <0.05 were considered statistically significant. Differences between observation periods were checked using the paired Student's t test.

Results

The postoperative periods in all patients passed without complications, there were no serious intraoperative or immediate postoperative complications. 6 months after the prosthetic rehabilitation, clinical and X-ray studies showed no signs of inflammation in the area of the implants.

Treatment of periodontitis resulted in a reduction in both PPD and BOP compared to baseline clinical outcomes. Implant surgery was performed 3 months after periodontal therapy, when PPD <4 mm and BOP <10%, with stable clinical index. The mean BOP before treatment was 2.6 ± 0.32, after 1month treatment the mean BOP 1.8 ± 0.2, after 3 months treatment the mean BOP 1.4 ± 0.15 (p >0.05), PPD before treatment was 5.41 ± 0.77 mm, 1 month after periodontal therapy it was 2,27 ± 0.38 mm and 3 month after therapy it was 2.46 ± 0.42).

After 12-month in patients mean MBL 0.76 ± 0.6 mm, after 5 years MBL was 1.34 ± 0.25 mm (P> 05), after 10 years MBL was 1.56 ± 0.28 mm (P> 05). With dynamic observation, clinical and radiological indices were stable, of the 234 implants installed, 2 implants failed to osseointegrate, 7 implants were lost after 5 years of loading (peri- implantitis), 6 implants were lost after 10 years

of loading (peri-implantitis). Survival rate of implants 5 years after was 96.4%, after 10 years was 93.6%.

Discussion

Despite the rapid development of oral implantology, the percentage of implant failures is still preserved**.** Peri-implantitis is one of the most common complications in patients with implants [33]. The etiology of peri-implantitis is multifactorial and the presence of periodontitis is one of the most important risk factors for peri-implantitis [34]. Periodontitis leads to a change in the quality and quantity of the jaw bone, manifested by increased atrophy of the alveolar process and a decrease in bone density.

In healthy patients the process of bone remodeling constantly occurs, in which there is a balance between bone formation and resorption, but in patients with periodontitis, this balance changes and is reflected by an increase in the rate of resorption of the alveolar process. According to the literature, in patients with a history of periodontal disease and with type 2 diabetes mellitus, the percentage of peri-implantitis is high compared to periodontically healthy patients [35-39]. Patients with periodontitis have many clinical similarities with peri-implantitis, however, compared with periodontitis, peri-implantitis is more progressive [40,41]. Since at present the main reason for tooth loss is progressive periodontal disease, these patients make up a large group of candidates in need of restoration of lost teeth with the use of implants. In the literature, there is a lot of discussion about the prognosis of dental implantation in patients with periodontitis [42].

Long-term prospective studies of the results of the use of implants in patients with a history of periodontal disease and with type 2 diabetes mellitus are relevant and have important knowledge in the recommendation of implantation therapy in patients with periodontal disease [43-45]. With type 2 diabetes, protein synthesis is impaired, inhibiting the activity and maturation of osteoblasts, which causes serious disturbances in the processes of remodeling, formation and mineralization of bone tissue in the surgical area and slows down tissue healing [46,47].

In addition, deterioration of the periodontal condition and a decrease in the immune response in diabetic patients increase the prevalence of postoperative infection and the development of peri-implantitis, leading to implant failures. This article is the analysis of the long-term results of 42 patients with moderate periodontitis and partially edentulous submitted to periodontal therapy/maintenance and implant placement with further prosthetic rehabilitation.

All patients befor implant surgery periodontal therapy were treated, which included the following: supragingival and subgingival scaling, root debridement and magnetic laser irradiation 7 days, use of local and systemic antibacterial agents. Implant treatment was carried out in those patients who had registered a decrease in periodontal indices after periodontal therapy compared with the baseline clinical results. Follow-up visits were one week and one, three and six months after the implantation, and then once a year. At each follow-up visit, biological and technical complications were assessed. 5 years after implantation therapy, the implant survival rate was 96.4%, implants 10 years after was 93.6%. Loss of implants occurred in those patients who did not undergo regular preventive examinations and went out of control. Untreated periodontitis is a risk for implant complications. The cumulative survival of implants and MBL in patients with a history of periodontitis shows the effectiveness of the use of implants for prosthetic rehabilitation in this category of patients. When planning dental implant, patients with periodontitis supportive periodontal therapy must necessarily begin before implants installation. The inclusion of magnetic laser therapy is effective in complex treatment of periodontitis.

Adequate control of periodontal infection and achievement of a stable periodontal status of the residual teeth is a key factor in increasing the long-term survival of implants, may provide a better prognosis. Diabetic patients can be successfully treated for all types of edentulism with dental implants if the diabetic plasma glucose level is normal or close to normal (with HbA1c levels <7.2% or less than 154 mg/dL).

Conclusion

This study confirmed that implant therapy can be successfully used in patients diagnosed with moderate periodontitis and with type 2 diabetes mellitus who have received individualization supportive periodontal therapy and regular periodontal maintenance.

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Ethical Approval

Research protocol was approved by the local Ethical Committee (29.09/23) and in accordance with those of the World Medical Association and the Helsinki Declaration.

Competing Interests

The author declares that he has no conflict of interest and there was no external source of funding for the present study. None of the authors have any relevant financial relationship(s) with a commercial interest.

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Availability of data and materials

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