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Dynamics of biochemical changes under the influence of comprehensive treatment of patients with generalized periodontitis and osteopenia

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Abstract

The issue of surgical treatment of patients with generalized periodontitis and osteopenia is particularly topical. Numerous studies have confirmed the benefits of surgical treatment procedures using osteoplastic material to stimulate repair process of periodontal tissues. The objective of the research was to improve the effectiveness of surgical treatment of patients with generalized periodontitis and osteopenia through the combined use of osteoplastic material and antiresorptive drugs in the preoperative and postoperative periods.

80 patients underwent treatment and clinical observation. The patients were divided into 3 groups. Group I included 20 patients who underwent surgical treatment according to conventional procedure. Group II included 20 patients who underwent surgical treatment with topical application of osteoplastic material "Easy Graft". Surgical treatment in Group III (20 patients) was conducted using osteoplastic material "Easy Graft" and antiresorptive drug "Bonviva". Control group consisted of 20 apparently healthy individuals. The obtained results indicated that surgical treatment with the combined use of osteoplastic material "Easy Graft" and antiresorptive drug "Bonviva" leads to process stabilization being confirmed by clinical study indices both in early and in remote postoperative period.

Keywords: Generalized periodontitis; osteopenia; osteoplastic material; antiresorptive drug

Introduction

Generalized periodontitis (GP) is a common disease. Its frequency increases with age and is characterized by inflammatory and resorption and destructive processes in the patient's periodontal tissues. Numerous factors that cause generalized periodontitis include osteopenia and jaw bony tissue osteoporosis [1, 2]. The study of the relationship between metabolic disorders of skeletal system and periodontal diseases is essential in order to determine the role of systemic factors of bone metabolism regulations and to ground pharmacological improvement of dystrophic destructive processes in the bony tissue [3]. Jaw bony tissue performs the supporting function of periodontal tissues and is also a reserve depot of minerals as part of the skeletal system of the body [4]. Surgical treatment is an integral part of GP comprehensive treatment. Surgical treatment of periodontal disease is the most effective method of obtaining stable positive results [5-7].

Surgical treatment of periodontal disease yet does not provide sufficient conditions to eliminate the pathological process in the bone structure of jaw bones as skeleton mineral density and the features of bony tissue metabolism in people of different age and sex is not taken into account [8, 9]. Numerous studies have confirmed the benefits of surgical treatment procedures using osteoplastic material to stimulate repair process of periodontal tissues [10, 11]. The objective of the research was to improve the effectiveness of surgical treatment of patients with generalized periodontitis and osteopenia through the combined use of osteoplastic material and antiresorptive drugs in the preoperative and postoperative periods.

Materials and methods

80 patients at the age of 24 to 65 were examined, treated and underwent clinical observation during the research. Patients with somatic diseases in the decompensation stage, malignant neoplasms, decompensated diabetes, and infectious diseases were excluded from the research. Patients were divided into three groups. Group I included 20 patients with GP and osteopenia who underwent surgical treatment according to conventional procedure. Group II included 20 patients with GP and osteopenia who underwent surgical treatment with local application of Osteoplastic material "Easy Graft".

Surgical treatment in Group III (20 patients with GP and osteopenia) was conducted using osteoplastic material “Easy Graft” and antiresorptive drug “Bonviva”. Control group consisted of 20 apparently healthy individuals.

All patients with GP and osteopenia underwent classical Cieszyński-Widmann-Neumann surgery for the periodontium of the appropriate jaw. Mouth cavity was irrigated with antiseptic solutions and anesthesia was performed with Sol. Ubistesini 4%. Two vertical incisions from the gingival margin to transitory fold of the pathological process margins and horizontal incisions along the gingival margin from labial and lingual (palatal) sides were performed. Modified gingival margins with the width of about 2mm were cut with scissors. Granulation tissue, dental plaque was removed. Bone edge was treated and tooth root was polished. Bone cavities were filled with “Easy Graft” material. “Easy Graft” hardened and acquired a shape of monolithic implant, but a porous one when combined with oral fluids. Mucoperiosteal flap was mobilized, cast in place, and stitched in the interdental spaces. Antiresorptive drug “Bonviva” and background drug therapy, namely Azithromycin-Astrapharm 500 mg in a dose of 1 capsule during 3 days (course dose of 1.5 g), Loratadine in a dose of 1 tablet (10 mg) once a day during 10 days and Laktovit Forte in a dose of 1 capsule 2 times a day during 10 days was prescribed.

Patients of Group I who were treated with background drug therapy underwent classical Cieszyński-Widmann-Neumann surgery for the periodontium of the appropriate jaw, namely 18 surgeries on the lower jaw and 2 surgeries on the upper jaw. One surgery was performed in 18 (90.0%) patients, two surgeries were performed in 1 (10.0%) patient.

All patients of Group II who were treated with background drug therapy using osteoplastic material “Easy Graft” in the comprehensive treatment underwent classical Cieszyński-Widmann-Neumann surgery for the periodontium of the appropriate jaw, namely 16 surgeries on the lower jaw and 4 surgeries on the upper jaw. One surgery was performed in 16

(80.0%) patients, two surgeries were performed in 2 (20.0%) patients.

All patients of Group III who were treated with background drug therapy using osteoplastic material and antiresorptive drug underwent classical Cieszyński-Widmann-Neumann surgery for the periodontium of the appropriate jaw, namely 16 surgeries on the lower jaw and 4 surgeries on the upper jaw. One surgery was performed in 16 (80.0%) patients, two surgeries were performed in 2 (20.0%) patients.

Structural and functional state of bony tissue was studied using markers of bony tissue metabolism in order to assess the course of the disease and treatment effectiveness. One of the bone formation markers is osteocalcin. Immunoenzymometric test Nordic Bioscience Diagnostics A/S N-MID Osteocalcin ELISA (Denmark) was applied to determine osteocalcin quantity in blood serum. Its reference indices constitute 9.6-40.8 ng/ml in men, 8.4-33.9 ng/ml in women of perimenopausal age, 9.5-48.3 ng/ml in postmenopausal women. Deoxypyridinoline is a specific and highly sensitive marker of resorption. Deoxypyridinoline level in urine was determined according to immunoenzyme method with the use of DPD EIA KIT (USA). Reference indices constitute 3.0-7.4 n/mol for women (25-44 years of age), 2.3-5.4 n/mol for men (25-55 years of age). Clinical research was analyzed before the operation, on the first, second, third, fourteenth day after the operation and in 6 months after the surgery.

During the statistical analysis of the results all the calculations were performed according to variation statistics method with the use of STATISTICA, the application package of computer program of medical and statistical calculations.

Results and discussion

Biochemical studies conducted in patients with GP and osteopenia Group I revealed indices improvement after the surgical treatment (Table 1).

Table 1

Dynamics of bony tissue metabolism indices in patients of Group I

Metabolism indices	Healthy, n=20	Before the treatment, n=20	After the treatment	
			In 3 months	In 6 monthd
Osteocalcin,ng/ml	30.68±0.74 4	18.84± 0.85	23.05±0.08 * •	24.16±1.15 •
Deoxypyridinoline,n/mol	3.42±0.13	6.32±0.34	5.34±0.87 * •	4.48±1.64 •

Note. * - probability of difference from healthy individuals, $p < 0.05$;
 • - probability of difference before and after the treatment, $p < 0.05$.

According to the results of biochemical study, osteocalcin level increased by 18.26% ($p < 0.05$) and deoxypyridinoline level decreased by 18.35% ($p < 0.05$) in patients of Group I in 3 months after the operation in comparison with the initial level before the operation. In 6 months after the treatment osteocalcin level increased by 22.02% ($p < 0.05$) and deoxypyridinoline decreased by 41.07% ($p < 0.05$) in patients of Group I in comparison with the initial level before the operation. This indicated their improvement compared to the

initial level before the operation. However, these indices were significantly different from those in healthy people. Thus, surgical treatment based on back ground therapy did not sufficiently affect bony tissue the mineralization in the remote postoperative period.

Analysis of biochemical indices of patients in Group II detected their positive dynamics (Table 2).

Table 2

Dynamics of bony tissue metabolism indices in patients of Group II

Metabolism indices	Healthy, n=20	Before the treatment, n =20	After the treatment	
			In 3 months	In 6 months
Osteocalcin,ng/ml	30.68±0.74	18.67± 0.83	25.21 ±0.12 * •	26.86±1.14 •
Deoxypyridinoline,n/mol	3.42±0.13	5.87±0.41	4.74±0.23 * •	3.81±0.42 •

Note. * - probability of difference from healthy individuals, $p < 0.05$;
 • - probability of difference before and after the treatment, $p < 0.05$.

According to the results of biochemical study, osteocalcin level increased by 25.94% ($p<0.05$) and deoxypyridinoline level decreased by 30.49% ($p<0.05$) in patients of Group II in 3 months after the operation in comparison with the initial level before the operation. In 6 months after the treatment, osteocalcin level increased by 23.84% ($p<0.05$) and deoxypyridinoline decreased by 54.06% ($p<0.05$) in patients of Group II in comparison with the initial level before the

operation. However, despite the positive dynamics of bony tissue metabolism indices, they still did not reach the level of healthy individuals.

Biochemical studies conducted in patients with GP and osteopenia Group III revealed indices improvement after the surgical treatment (Table 3).

Table 3

Dynamics of bony tissue metabolism indices in patients of Group III

Metabolism indices	Healthy, n=20	Before the treatment, n=20	After the treatment	
			In 3 months	In 6 months
Osteocalcin, ng/ml	30.68±0.54	18.96± 0.86	27.32±0.32 * •	29.54±1.09 •
Deoxypyridinoline, n/mol	3.42±0.13	5.88±0.31	3.84±0.54 * •	3.68±1.14 •

Note. * - probability of difference from healthy individuals, $p<0.05$;

• - probability of difference before and after the treatment, $p<0.05$.

According to the results of biochemical study, osteocalcin level increased by 30.60% ($p<0.05$) and deoxypyridinoline level decreased by 35.82% ($p<0.05$) in patients of Group III in 3 months after the operation in comparison with the initial level before the operation. In 6 months after the treatment osteocalcin level increased by 53.13% ($p<0.05$) and deoxypyridinoline decreased by 65.17% ($p<0.05$) in patients of Group III in comparison with the initial level before the operation. This indicated their improvement compared to the initial level before the operation.

Biochemical indices remained the best in the patients of Group III in comparison with patients in groups I and II in all periods after treatment. Surgical treatment with the use of osteoplastic material an antiresorptive drug contributed to the most significant positive effect on changes in biochemical indices in patients with GP and osteopenia.

Conclusions

1. Positive dynamics of biochemical indices of osteocalcin and deoxypyridinoline is observed in patients with GP and osteopenia after surgical treatment based on the background therapy. Surgical treatment based on the background therapy does not provide sufficient stabilization of GP biochemical manifestations in the remote postoperative period.
2. The use of "Easy Graft" osteoplastic material in the surgical treatment of patients with GP and osteopenia promotes positive dynamics of biochemical indices of osteocalcin and deoxypyridinoline.
3. The combined use of osteoplastic material "Easy Graft" and antiresorptive drug "Bonviva" leads to process stabilization being confirmed by biochemical indices of osteocalcin and deoxypyridinoline both in early and remote postoperative periods.
4. The developed regimen of surgical treatment of patients with chronic II and III stage GP and osteopenia in combination with pharmacological therapy increasing surgical treatment efficiency and promoting stabilization process is safe and accessible in dentist's practice.

Prospects for further research

Taking into account high GP prevalence, the issue of further study of osteoplastic material "Easy Graft" and antiresorptive drug "Bonviva" impact on densitometric manifestations both in early and remote postoperative period becomes relevant.

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