

## FEATURES OF DENTAL IMPLANTS IN THE COMPLEX TREATMENT OF PERIODONTAL DISEASE

***Halyna Prots***

*Department of Oral and Maxillofacial  
Ivano-Frankivsk National Medical University  
2 Galitska str., Ivano-Frankivsk, Ukraine, 76000  
galina170870@gmail.com*

***Mykola Rozhko***

*Department of postgraduate education  
Ivano-Frankivsk National Medical University  
2 Galitska str., Ivano-Frankivsk, Ukraine, 76000*

***Vasyl Pjiryk***

*Department of Oral and Maxillofacial  
Ivano-Frankivsk National Medical University  
2 Galitska str., Ivano-Frankivsk, Ukraine, 76000  
IFNMUstomat@ukr.net*

***Iryna Prots***

*Ivano-Frankivsk National Medical University  
2 Galitska str., Ivano-Frankivsk, Ukraine, 76000  
Irka050696@gmail.com*

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### **Abstract**

**Aim:** To Improve the treatment of patients with partial edentia and chronic generalized periodontitis by including dental implantation to the complex of therapeutic measures.

**Materials and methods:** There have been presented the results of 240 patients with varying severity degrees of generalized periodontitis who underwent surgery on periodontal tissues with dental implantation. The research was conducted at the OCH of Ivano-Frankivsk 2007–2017. To improve the efficiency for dental implants and periodontal surgical intervention is necessary to determine the quality of bone remodeling, identifying markers of bone tissue metabolism.

**Results:** It was established that in 40,81 % patients the results of research showed markers of bone remodeling indicating a high rate of bone formation ( $25,12 \pm 2,23$  ng/ml) and a slight increase in rate of resorption marker, which results in low rates of bone resorption ( $8,54 \pm 1,23$  nmol/L). These patients were not prescribed with osteotropic drugs. 50,83 % of patients with osteopenia were noticed to manifest the formation of bone possible raise of bone resorption ( $10,82 \pm 1,34$  n/mole), which was the indication for antiresorptive medication prescription. In 8,36 % of patients with osteoporosis was observed inhibition of bone formation processes ( $18,05 \pm 2,08$  ng/ml) and increased resorption indices ( $15,34 \pm 1,87$  nmol/L). Medications that stimulate osteogenesis and prevent bone resorption were prescribed.

**Conclusions:** When planning dental implants and periodontal surgical intervention it is necessary to identify markers of bone remodeling to assess the structural and functional state of bone tissue and prescribe osteotropic drugs that promote positive postoperative period.

**Keywords:** generalized periodontitis, dental implants, structural-functional state of bone tissue.

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### **1. Introduction**

The problem of replacing defects in the dentition has remained a topical issue of modern theoretical and practical stomatology for more than a decade. The use of traditional prosthetic methods is not always effective, especially in persons of working age, who prefer permanent denture structures [1, 2].

Therefore, the actual problem of rehabilitation of patients with dental defects by dental implants is in contrast to traditional methods. Over the past three decades, the method of implanting

teeth has become one of the leading in replacing defects in the dentition, aimed not only at the restoration of masticatory function, but also at obtaining a high predicted result of orthopedic rehabilitation of dental patients [3, 4].

At the same time, the combination of defects in dentition with diseases of periodontal tissues, especially in young people, complicates the choice of rehabilitation measures, which, together with other etiological factors, leads to complications of pathology and shortened use of dentures [5, 6].

The basic method of orthopedic treatment of patients with chronic forms of generalized periodontitis (GP), which are usually accompanied by loss of teeth, is prosthetic dental bridges, which leads to an overload of supporting teeth [7, 8].

Inflammatory and degenerative processes in periodontal tissues in 80 % of cases involve loss of teeth. At 42.8–87.4 % of the prevailing reason that enhances inflammatory degenerative processes are abnormal overload of the tooth supporting tissues. This greatly aggravates during chronic GP: promotes the formation of periodontal pockets, baring the necks of the teeth and inflammation in the area of marginal periodontium [9].

The general rule for periodontal treatment is to eliminate etiologic factors for the normalization of its properties. The best orthopedic treatment is defined to be a structure with additional support on endosseous implants. As a result of redistribution of the load on teeth and implants, the occlusal periodontal trauma is reduced, or even eliminated, atrophy of the edentulous jaw areas under the influence of functional overload slows by 2–3 times [10, 11].

Many periodontists recommended gradual and consistent implementation of all periodontal procedures, which significantly increases the length of treatment and is burdensome for working patients [12, 13].

According to literature, more than 66 % of patients with generalized periodontitis have different structural and functional disorders of the bone tissue that require a more balanced approach to the treatment method and additional measures to prevent the loss of dental implants during the treatment stages [14].

Possibilities and conditions for performing one visit surgery on periodontal tissues and implantation in patients with varying severity of chronic GP in general are not enough researched.

## 2. Aim of research

To improve the treatment of patients with partial edentia and chronic generalized periodontitis by including dental implantation to the complex of therapeutic measures.

## 3. Materials and methods

There was conducted a survey of 240 patients with mild, moderate and severe degrees of chronic generalized periodontitis with partial edentia of upper and lower jaw, who were later treated with comprehensive periodontal treatment using the methods of dental implants. The study was conducted at the dental department of Ivano-Frankivsk Regional Hospital 2007–2017. 340 titanium implants type “U-impl”, Entegra (Innova, Canada), SuperLine (Korea) were used. 196 implants were placed in the mandible, 71 implants in the upper jaw, 73 implants installed simultaneously on the upper and lower jaws. Implants were inserted using two-stage method on included defects – 125 patients (55.8 %), final – 85 patients (37.9 %), combined – 14 patients (6.3 %).

Clinical examination included: complaints, duration of disease, the incidence of abscesses, duration of remission, the presence and nature of chronic physical illness, stress, previously carried out treatments, especially the use of antibiotics and surgery and its results, investigated the reasons why patients preferred use of dental implants. During the clinical examination there was studied the state of the mucous membranes of the mouth, the presence or absence of inflammatory changes, density of mucous that cover implants and the bone tissue around them was assessed visually and by palpation.

For an objective evaluation of periodontium there was used Schiller-Pisariev’s test, Green-Vermillion oral hygiene index, Muleman bleeding index, Ramfjord index, and Svračkov’s

iodine number was determined. There was also examined the state of periodontium using X-ray examinations (panoramic radiogram, target radiograms).

According to many authors, the periodontal surgery itself will not create sufficient conditions for the elimination of the pathological process of bone structures in alveolar processes, if not to consider the mineral density of the skeleton and feature bone metabolism in people of all ages and gender. Reduced bone mineral density may negatively affect the periodontal tissues and reduce the terms of functioning implants [15, 16].

The functional state of bone tissue was evaluated by the method of dual-photon X-ray absorptiometry with the help of the apparatus named Challenger (DMS, France). Evaluation of structural and functional state of bone was performed, identifying markers of bone tissue metabolism that react faster in comparison with densitometry. The most specific marker of bone formation is osteocalcin, which reflects the level of circulating bone formation rate [17]. For the quantitative analysis of serum osteocalcin level, the immune-ferment test Nordic Bioscience Diagnostics A/SN-MID Osteocalcin ELISA (Denmark) was used; referent indices range between 9.6–40.8 ng/ml for men, 8.4–33.9 ng/ml for women in premenopause, 9.5–48.3 ng/ml for women in post-menopause. Highly sensitive and specific marker of bone resorption is deoxypyridinoline, high levels of which in urine indicate increased bone resorption. Deoxypyridinoline is released from bone material in case of its resorption by osteoclasts and it is a highly sensitive and specific marker of resorption. Extremely high urine deoxypyridinoline level indicates increased bone resorption. The level of deoxypyridinoline in urine was defined by immune-ferment method with the help of DPD EIA KIT (USA); referent indices range between 3.0–7.4 n/mole for women aged 25–44 and 2.3–5.4 n/mole for men aged 25–44.

In pre-operative course, all the patients underwent the following procedures: elimination of local factors, which contributed to the accumulation and activation of the microbial factor effect, splinting loose teeth, held local anti-inflammatory therapy, differential osteotrophic therapy, taking into consideration the results of the bone remodeling markers study [18, 19].

Surgery for periodontal tissues were performed by using vestibuloplasty by Erokhin, frenuloplasty by Limberg, proposed flap operation using osteogenic transplant and autograft bone marrow [20, 21]. Dental implantation was carried out by the conventional protocol. Patients underwent a gradual periodontal intervention followed by dental implants or surgical intervention on periodontal tissues and implantation carried out in one stage [22].

When phased dental treatment was performed, patients underwent implantation not faster than 3 months after periodontal intervention, after elimination of inflammation and stabilization of periodontal tissues. Prosthodontic treatment was performed 3–6 months after the surgery. That means that period from the start of treatment to the prosthesis averaged no less than 9 months [23].

One-stage surgery was performed after the dental hygiene. The first stage of the operation realized curettage of bone pockets, vestibuloplasty, frenuloplasty, performance of proposed flap operation using autograft bone marrow and osteogenic transplant, preparing the implant bed, including increase of atrophied alveolar ridge bone's volume. One-stage surgery and implantation reduced treatment duration in 1.5–2 times.

Performance of proposed flap operation showed that red bone marrow contains stem cells, which have a great potential for growth and proliferation and a great ability to differentiate and have immunoregulator and hematopoietic effects. Functionally, they are active cells for production of growth factor and regeneration.

Before performing surgery local factors which contribute to the accumulation and activation of microbial action were eliminated. Before the initiation of the surgery red bone marrow was collected from posterior iliac crest bone, occasionally it can also be collected from chest bone, after normal sterilization, procedure is carried under local anesthesia. 7.0 ml of red bone marrow is aspirated into a bone marrow aspirating syringe which contains 0.5 ml of anticoagulant. Patient may feel slight discomfort and pain. The autologous bone marrow is mixed with collagen in 1:1 ratio parts by weight. The first stage of the surgery was initiated with the trapezoidal in section with the incision along the gingival margin keeping the architecture of the gingival margin into consideration at the angle close to 30 degree, then a horizontal periosteal incision is made and the flap is

reflected, granulation tissue, plaque and other debris are removed. Then the pockets are filled with osteogenic material "Fiizohraft" and a mixture of autologous bone marrow and collagen sponges are placed and the flap is closed back into position either raising or lowering the margins. In the post-operative period, all patients were prescribed with anti-inflammatory preparations, analgesics and antibiotics [16].

In the postoperative period, all patients were prescribed with anti-inflammatory, detoxification, analgesic therapy. Clinical evaluations were conducted in the dynamics before and after surgery at 1, 6 and 12 months. X-ray parameter was evaluated before treatment and after 12 months.

According to the degree of severity of chronic generalized periodontitis patients were divided as follows:

Group 1: mild periodontitis – 107 people, including 50 patients, who underwent one-stage implantation of periodontology surgical intervention, 57 patients – step by step periodontal treatment followed by implantation;

Group 2: moderate periodontitis – 97 people, including 40 people held one-stage implantation with surgical periodontal treatment, 49 – step by step periodontal treatment followed by implantation;

Group 3: severe periodontitis – 36 people 16 – refused implantation due to significant bone resorption, 20 patients underwent periodontal surgery and gradually implantation.

#### 4. Results of research

The results of densitometry showed that:

In group I – 50 (47 %) patients with bone mineral density ( BMD ) within the normal range, 57 (53 %) patients with reduced BMD (50 – osteopenia, 7 – osteoporosis).

In the second group – in 38 (39 %) patients with BMD within the normal range, 59 (61 %) patients with reduced BMD (osteopenia in 52 patients, osteoporosis in 7 patients).

In the third group, 10 (28 %) patients with BMD within the normal range, 26 (72 %) patients with reduced BMD (20 patients – osteopenia in 6 patients – osteoporosis). Thus, only 38 % of patients with surgery performed on a background of normal BMD, and 62 % – reduced BMD.

In studying the bone tissue metabolism in 50 (47 %) patients of I group with normal bone density, there was a slight inhibition of bone formation processes (*osteocalcin* – 20, 68±2.54 ng/ml) and a significant increase in bone resorption rates (dioxypyridipolin – 9.42±1.13 nmol/L). 50 (47 %) patients with osteopenia were noticed to manifest the formation of bone tissue within normal range (*osteocalcin* – 22.76±1.15 ng/ml) and a possible raise of bone resorption (dioxypyridipolin – 10.82±1.34 nmol/L), which was the indication for antiresorptive medication prescription. In 7 patients (6 %) with osteoporosis was observed inhibition of bone formation processes (*osteocalcin* – 18,05±2,08 ng/ml) and increased resorption indices (dioxypyridipolin – 15,34±1,87 nmol/L). *Osteocalcin is a marker of bone formation in order to determine the level it uses a plasma blood and is measured in ng/ml.* Dioxypyridipolin is a resorption marker, which is *measured in nmol/L.*

The study of bone metabolism in 38 (39 %) patients with Group II with BMD in the normal range, indicates high bone formation time (*osteocalcin* 25.12±2.3 ng/ml), and an increase in the indicator of resorption marker results in high rates of bone resorption (dioxypyridipolin – 8.54±1.23 nmol/L). In 59 patients with osteopenia and osteoporosis (61 %), the level of *osteocalcin* was 22.67±1.83 ng/ml, 18.21±1.32 nmol/L, and the increased bone resorption rate (12.87±1 41 for dioxypyridipolin) nmol/L; 16.54±1.23 nmol/L).

Metabolism of bone with normal density in 10 (28 %) patients of the III group is characterized by slight constipation of bone formation processes of bone resorption (*osteocalcin* – 22,68±2.45 ng/ml) and an increase in bone resorption rates (dioxypyridipolin – 9.42±1.42 nmol/L). 20 (55, 5 %) patients with osteopenia and 6 with (16,5 %) osteoporosis have bone formation suppressing (*osteocalcin* – 21.76±2.06 ng/ml, 17.22±1.32 ng/ml) and significantly increased bone resorption (dioxypyridipolin – 10.82±1.21 nmol/L, 15.34±16, 54 nmol/L).

The success of periodontal surgery in recent years is associated not only with the elimination of periodontal pockets, but also with the usage of the means and methods to stimulate regener-

ative processes in periodontal tissues. Proposed and developed method of surgical treatment of generalized periodontitis using bone replacing material enriched in active osteogenic component [16].

In patients of the first group, during the one-stage dental implantation and periodontal surgery (curettage of tooth- gingival pockets, vestibuloplasty, plastic bridle ) and patients who underwent staged surgical treatment of periodontal tissues, followed by dental implants, statistically significant differences were not found.

Comparative analysis showed that the occurrence of postoperative patients of this group during the one-stage dental implants, periodontal intervention and phased treatment according to clinical (redness, swelling, pain, gum color) and radiographic controls differed significantly, elimination of inflammation in periodontal tissues after treatment was observed in 94.8 % of subjects .

In 5–6 days in these patients, signs of inflammation were observed. Moderate collateral edema in most patients disappeared in 4 days. The mucous flap in the first days after surgery was pink or pale pink. A wound was healed with primary intention. Pain during palpation of the mucous membrane in the area of wound was not observed. Mobility of teeth that occurred after surgery disappeared in 5–6 weeks. In 1 month after surgery inflammation was not observed, gingival margin densely covered dental neck, depth of periodontal pockets decreased by postoperative scarring of the mucosal flap and regeneration of bone tissue. Absence of inflammation in the gingival tissues, was proved by a sharp decrease of basic periodontal indices in positive dynamics. In 12–18 months after treatment clinical and radiological stabilization of periodontal tissue occurred in 83.4 % of patients. The mucosa around implants became pale pink. Implant mobility was not observed, percussion is not painful. In 2 patients developed periimplantitis, 1 patient in the area of the implant gum recession was observed. In one year in this group of patients all implants were retained. Resorptive process around implants in 5 years resulted in bone loss in average at  $0,8\pm 0,3$  mm.

In group II, patients who underwent staged periodontal treatment followed by dental implants observed positive dynamics of clinical changes and the term regression of clinical signs of inflammation was late by an average of 2–3 days, in patients who simultaneously held implantation and surgery on periodontal tissues, there was reduced dynamics of periodontal probes and indexes. In 12–18 months after treatment clinical and radiological stabilization occurred in 80.2 % of patients with momentary dental implant and periodontal intervention, 82.8 % – in patients with stage treatment. Mucosa in the area of implant was pale pink, percussion was not painful. After a one-step dental implants and periodontal intervention in 4 patients developed periimplantitis, in 5 patients recession around implants was observed, in 2 patients were no stabilization of the implants, thus the signs of disintegration of the implant indicated a need to remove them. In a phased treatment periimplantitis developed in 2 patients, gingival recession was not observed, no stabilization – in 1 patient. Reduction of the height of the alveolar bone after 5 years in patients with momentary conducted dental implants and periodontal intervention amounted to an average of  $2,4\pm 0,2$  mm and with gradual –  $1,9\pm 0,1$  mm.

In 20 patients of the third group with severe GP, only gradually periodontal treatment was carried out, followed by dental implants. 16 patients of this group were refused implantation due to significant bone resorption. As a result of the interference minor periodontal inflammation was observed, gingival edges tightly did not cover the neck of the teeth, periodontal pocket depth decreased slightly. In 4 patients developed periimplantitis, 2 patients showed gingival recession in the area of implants. Resorptive process around implants led to bone loss by an average of  $3,2\pm 0,2$  mm. As the result, the bone loss led to the disintegration of four implants.

## 5. Discussion

It was established that in 40,81 % patients the results of research showed markers of bone remodeling indicating a high rate of bone formation (*osteocalcin* –  $25,12\pm 2,23$  ng/ml) and a slight increase in rate of resorption marker, which results in low rates of bone resorption (dioxypyridipolin –  $8,54\pm 1,23$  nmol/L). These patients were not prescribed with osteotropic drugs. The 50,83 % patients with osteopenia were noticed to manifest the formation of bone possible raise of bone resorption (dioxypyridipolin –  $10,82\pm 1,34$  nmol/L), which was the indication for antiresorptive medication prescription. In 8,36 % patients with osteoporosis was observed inhibition of bone

formation processes (*osteocalcin* –  $18,05 \pm 2,08$  ng/ml) and increased resorption indices (dioxypyridinopolin –  $15,34 \pm 1,87$  nmol/L). Medications that stimulate osteogenesis and prevent bone resorption were prescribed.

Thus, the results of the study of the bone resorption and formation markers allowed to prescribe – Osteogenon in tablets – 1 tabl., twice per day, duration of treatment is 3 months, purposefully to patients who had inhibited processes of bone formation medications that stimulate bone osteogenesis. Patients, who had increased bone resorption were prescribed with antiresorptive – Calcium D3 Nycomed – 1 tabl. twice a day for 3 months.

The results of the study indicate that in Group I of patients pathological processes in periodontal tissues develop in 47 % against normal bone tissue, and implantation in patients, who have mild generalized periodontitis, can achieve consistent results regardless of the choice of treatment.

In 39 % of patients of Group II of pathological processes develop on the background of normal bone tissue, and in 61 % – pathological processes in periodontal tissues associated with low density of bone tissue. Given the slow dynamics of indicators of periodontal probes and indexes, there are often postoperative complications in patients undergoing single-stage implantation and periodontal surgery. It is advisable in patients with generalized periodontitis of moderate severity to conduct a phased surgical treatment of periodontal tissues, followed by dental implants.

Research results show that in 72 % of patients in Group III pathological processes in periodontal tissues develop with a low density of bone tissue and only in 28 % of patients – against the background of normal bone tissue. Therefore, in patients with severe GP, only gradually periodontal treatment was performed, followed by dental implants. Although 16 patients in this group were denied implantation due to significant resorption of bone tissue. In 4 patients developed periimplantitis, 2 patients showed gingival recession in the area of implants. Resorptive process around implants led to bone loss by an average of  $3,2 \pm 0,2$  mm. As the result, the bone loss led to the disintegration of four implants.

Thus, at this stage in the case of the need for dental implantation in patients with generalized periodontitis, it is considered to be appropriate to conduct cross-sectional performance of surgical intervention on periodontal tissues and dental implants in patients with mild severity, which in 1.5–2 times shortens the duration of treatment without deterioration of the quality. In patients with generalized periodontitis of moderate and severe stages it is recommended to realize phased interventions following dental implantation to prevent postoperative complications and implant loss.

In the future, a planned analysis of the parameters of bone tissue metabolism in the dynamics of patients, which have generalized periodontitis, was performed by dental implantation.

This problem was studied by Pavlenko A., Mazur I.. In order to prevent the loss of marginal bone around dental implant, there is offered the general scheme of treatment of patients with generalized periodontitis by ibandronic acid and magnetic-laser therapy that promotes better adaptation of bone to new functional load conditions and reduces bone loss. The authors prove [14] that the progression of destructive processes in periodontal tissues is due to structural and functional disorders of bone metabolism, which can negatively affect the results of replacement of defects in dentition by dental implants. We advise a dental implantation of GP patients in order to obtain predicted results to pharmacologically correct metabolic bone disorders in 3–6 months before the planned surgical intervention.

Leonenko P. [13] studied features of the physical and mechanical properties of bone in areas of implantation in patients with generalized periodontitis and metabolic osteopathy. He revealed the presence of local changes in architectonics and strength of BT in patients with GP and metabolic osteopathy.

In the future, an analysis of the parameters of bone tissue metabolism in the dynamics of patients, who have generalized periodontitis, which was performed by dental implantation, is planned.

## 6. Conclusions

1. Dental implantation in patients with mild GP can achieve consistently good results regardless of treatment. Simultaneous surgery on periodontal tissues and dental implantation 1.5–2 times reduces treatment without reducing its quality.

2. In patients with moderate and severe GP, it is appropriate to conduct stepwise surgical interventions, following dental implantation to prevent postoperative complications and implant loss.

3. When planning for dental implants and periodontal surgical intervention it is necessary to identify markers of bone remodeling to assess the structural and functional state of bone tissue and prescribe osteotrophic drugs that promote positive postoperative period.

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## GENETIC FEATURES OF RESISTANCE TO ANTITHROMBOCYTIC DRUGS IN PATIENTS WITH ISCHEMIC HEART DISEASE AFTER CONDUCTED PERCUTANEOUS CORONARY INTERVENTION

*Ada Liakhotska*

*Department of propedeutic of internal medicine No. 1  
Bogomolets National Medical university  
13 T. Schevchenko blvd., Kyiv, Ukraine, 01601  
a.liakhotska@gmail.com*

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### Abstract

**The aim of the study:** To study and evaluate platelets aggregation activity as primary phase of haemostasis and anti-platelet therapy in IHD patients after PCI, depending on the polymorphism of the gene ITGA 2 – C 807T.

**Materials and methods:** 54 patients who were on a treatment at the clinical hospital “Feofaniya” (Kyiv) and at the Kyiv Clinical Hospital on railway transport No. 2 were examined: 20 women and 34 men (mean age – 67.8±7.46 years). The study involved patients with stable forms of coronary artery disease (stable angina pectoris II–III) and acute coronary syndrome, with a history of percutaneous coronary intervention (PCI). All patients received antiplatelet therapy: acetylsalicylic acid (3.7 %), clopidogrel (9.3 %) or a combination of them (87 %).

Functional activity of the platelets was studied on a Biola Aggregation Analyzer laser agrometer. The response to antiplatelet therapy was confirmed by the AggreDyne test. The polymorphism of the C807T of the ITGA2 gene was determined by polymerase chain reaction (PCR).

Based on the results of the aggregation ability, antiplatelet therapy sensitivity, the patients were divided into two groups: group I – individuals with varying degrees of insensitivity to antiplatelet drugs (35 patients), group II – susceptible to treatment (19 patients). In each group was analyzed the polymorphism of the gene ITGA2 and features of the functional activity of the platelets, depending on the genotype.

**Results:** In 50 % of patients receiving ASA there was a different degree of non-sensitivity, with respect to thienopyridines – this figure was 20 %. Among patients who received dual antiplatelet therapy did not match at least one of the drugs – 83.3%. Among the “non responders” 78.9 % had a mutated T-allele, and a homozygous variant for the T allele was recorded in 53.15 % of patients, while “respondents” – 15.8 %. Most in the group of “respondents” was the group of the native genotype – C/C. The most pronounced tendency to influence the genotype on spontaneous aggregation was observed in relation to the T-allele, in particular in the homozygote (genotype T/T). The significant difference between the groups was obtained from the platelet response to ADP. Thus, the reaction of carriers in the T-allele, as homo- and heterozygotes, was significantly different.

**Conclusions:** In 64.8 % of patients with coronary heart disease after PCI was observed a decrease in antiplatelet sensitivity, which has a clear link with the polymorphism of the gene ITGA 2. The presence of the T-allele in the genotype of patients with IHD is associated with a less adequate platelet response in patients receiving dual antiplatelet therapy for ASA and thienopyridines on ADP, which may have an effect on the sensitivity to thienopyridines.

**Keywords:** ischemic heart disease, platelets aggregation, percutaneous coronary intervention, antiplatelet treatment.