Efficacy of Platelet-rich Fibrin in the Treatment and Rehabilitation of Patients with Peri-implant Mucositis

Skuteczność fibryny bogatopłytkowej w leczeniu i rehabilitacji pacjentów z zapaleniem błony śluzowej wokół implantu

DOI: 10.36740/ABAL202205106

Nataliia G. Gadzhula, Maryna A. Gorai, Larysa F. Kurdysh, Olha Yu. Pylypiuk, Anastasiia V. Povsheniuk

National Pirogov Memorial Medical University, Vinnytsia, Ukraine

SUMMARY

Aim: To evaluate the effectiveness of injectable platelet-rich fibrin (i-PRF) in the complex treatment and rehabilitation of patients with peri-implant mucositis.

Materials and Methods: Clinical examination and treatment of 23 patients with peri-implant mucositis were carried out. Patients of the main group (n=11) were injected with liquid platelets-rich fibrin. In patients of the control group (n=12) the treatment protocol involved local antibacterial and anti-inflammatory therapy. The assessment of peri-implant tissues condition was performed on the basis of visual inspection, generally accepted instrumental and X-ray examination and was based on the data of periodontal tests and indexes.

Results: In 72.7% of patients after i-PRF usage, reduction of inflammation was observed on the 3rd day of treatment; on the 7th day the clinical status corresponded to the norm. At the same time, in the control group a decrease of inflammation signs was revealed only in 33.3% of patients on the 3rd day and in 66.7% on the 7th day; complete elimination of inflammation in all patients was registered on the 14th day of observation. In 12-month follow-up examination the positive dynamic of peri-implant mucositis treatment was maintained in 81.8% of patients of the main group and in 50.0% of patients of the control group.

Conclusions: The use of i-PRF in the complex treatment of peri-implant mucositis contributes to the rapid elimination of inflammation signs and bleeding of the gums surround the implants, accelerates the soft tissues regeneration, shortens treatment times and provides long lasting stabilization of the process.

Key words: dentistry, dental implant, peri-implant mucositis, treatment, platelet rich fibrin

Słowa kluczowe: stomatologia, implant zębowy, okołoimplantowe zapalenie błony śluzowej, leczenie, fibryna bogatopłytkowa

Acta Balneol, TOM LXIV, Nr 5(171);2022:412-416

INTRODUCTION

Non-compliance with the rules of rational prosthetics and hygienic care of implants contributes to the accumulation of biofilm on the implant superstructure and the development of a chronic inflammatory process in peri-implant tissues, which leads to peri-implant mucositis and peri-implantitis. Peri-implant mucositis has been defined as an inflammatory lesion of the mucosa surrounding dental implant, whereas peri-implantitis – is an inflammatory-destructive lesion that affects the surrounding mucosa with loss of supporting peri-implant bone or continuing marginal bone [1, 2]. The prevalence of peri-implant tissue diseases is quite high: peri-implant mucositis varies from 32 to 54% at different times after implantation, peri-implantitis – from 12 to 43% [1, 3, 4]. Long-term chronic inflammation in the peri-implant zone is the cause of the destruction and resorption of bone structures in the implant region, the appearance of peri-implantitis with a progressive nature of its course, resistance to treatment, a tendency to recurrences, that negatively affects the functioning of orthopedic superstructures on the implants and subsequently lead to their loss [5]. That is why prevention and treatment of inflammatory and destructive complications of dental implantation should be carried out in the early stages of peri-implant mucositis formation.

In the treatment of diseases of peri-implant tissues, in addition to mechanical cleaning, promising is the use methods based on the activation of reparative regeneration processes of tissue structures [6-8]. The essence of i-PRF technique is to inject liquid fibrin into the gums around the implant, which provides a long-lasting anti-inflammatory effect and stable remission of the disease [9, 10].

AIM

To evaluate the effectiveness of injectable platelet-rich fibrin (i-PRF) in the complex treatment and rehabilitation of patients with peri-implant mucositis.

MATERIALS AND METHODS

A clinical examination and treatment of 23 patients aged 30-50 years with peri-implant mucositis, which occurred in 6 months or more after placing dental implants, were carried out. Patients were divided into 2 groups: the main (n=11) and control (n=12). Patients with destructive forms of periodontal diseases, occlusal disorders, bruxism, TMJ pathology, systemic diseases, after radiation therapy in the head and neck were excluded from the study.

The clinical examination included collecting complaints, detailing an anamnesis, determination of hygienic condition of oral cavity and the condition of soft tissues in the peri-implant zone. The study was performed on the basis of a visual inspection, generally accepted instrumental and X-ray examination and was based on the data of periodontal tests and indexes.

Plaque accumulation around existing implants was determined using the plaque index adapted for dental implants (Modified Plaque Index [mPI]; Mombelli, Van Oosten, Schurch, & Land, 1987). The activity of the inflammatory process was assessed using the gingival index (Modified Gingival Index [mGI]) and the bleeding index (Modified Sulcus Bleeding Index [mSBI], modified for dental implants (Mombelli et al., 1987). The depth of gingival attachment to the implant was recorded using periodontal probe UNC 15.

In both groups of patients, the treatment included: elimination of local irritating factors, professional oral hygiene, scaling with Hu-Friedy titanium curettes, polishing of the implant surface with glycine, training in individual oral hygiene and its control, choosing of hygiene products. Patients of the control group were treated with local antibacterial and anti-inflammatory therapy, which included rinsing with 0.12% Chlorhexidine mouth rinse, twice daily and application of Cholisal gel ("ELFA A.T.", Poland) 2 times a day for 7-10 days. Patients of the main group were injected with platelet-rich fibrin (i-PRF), which was obtained by centrifuging the venous blood of patients without anticoagulants in special i-P tubes (Figure 1). For the formation of i-PRF, the centrifugation speed was 700 rpm, and the time was 3 min. The course of treatment included 1 injection after professional oral hygiene and, if necessary, 1 injection on the 7th day of treatment (Figure 2).

The clinical effectiveness of the proposed method was assessed before, on the 3rd, 7th and 14th day of treatment. The stability of the proposed treatment was confirmed by clinical and radiological methods in 12 months of follow-up dispensary observation. Statistical analysis of the research results was carried out using Microsoft® Excel 2017 computer programs for Mac and "Statistica 6.1". Statistical data processing was performed by methods of variation statistics with the calculation of average arithmetic and relative values and errors (M±m), (P±m), standard deviation (t) and the significance of differences (p-value, the differences were considered statistically significant at $p<0.05$). In the case of confirmation of the normal distribution law when comparing quantitative indicators between groups, we used parametric methods – Student's t-test for independent variables, and to identify differences in dynamics during therapeutic measures, Student's t-test for dependent variables.

Figure 1. Blood serum and leukocyte-platelet clot after centrifugation in 10.0 ml tubes

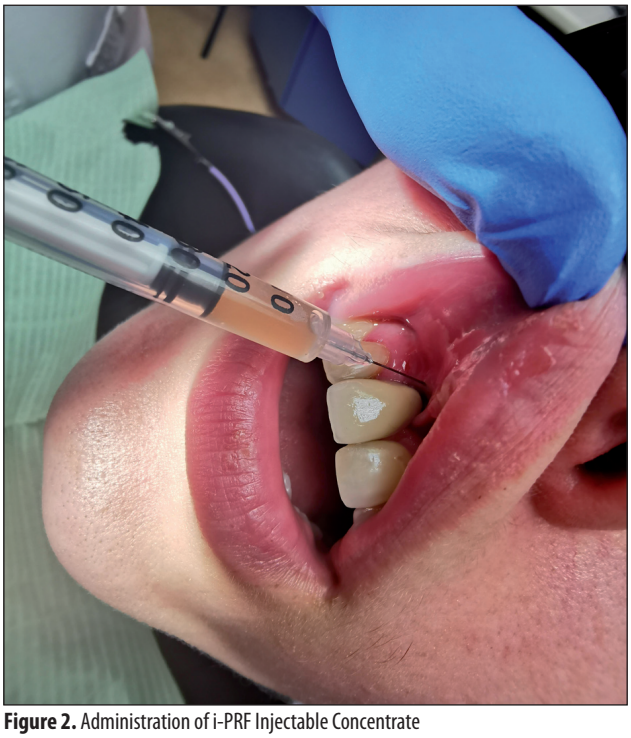

Figure 2. Administration of i-PRF Injectable Concentrate

The research was carried out in compliance with the main provisions of the "Rules of Ethical Principles of Scientific Medical Research Performing with Human Participation", approved by the Declaration of Helsinki, ICH GCP, EU Directive № 609, orders of the Ministry of Health of Ukraine № 690 dated 09/23/2009, № 944 dated 12/14/2009, № 616 dated 08/03/2012. The research protocol was approved by the Biomedical Ethics Committee of National Pirogov Memorial Medical University, Vinnytsya.

RESULTS

Before treatment, the patients of both groups complained of slight pain, bleeding, and periodic swelling of the gums around the implant-supported orthopedic superstructures. During objective examination the moderate redness, slight edema and bleeding of the soft tissues in the peri-implant zone were revealed (Figure 3a, 3b).

Friability and pastiness of the gingiva, pain of the gums on palpation and in some clinical cases the presence of granulations were observed, which indicates a long course of chronic inflammatory process in the peri-implant zone. In patients of the main and control groups, the implants were sufficiently osseointegrated and immobile.

According to X-ray data, no changes were revealed in the bone surrounding the dental implants. The results of the index assessment and periodontal status of patients in the studied groups before treatment were as follows: mSBI – 1.65 ± 0.14 scores; mGI – 1.35 ± 0.17 scores, mPI – 1.74 ± 0.16 scores, which indicated a high activity of the inflammatory reaction in the gums in the peri-implant zone and a low level of oral hygiene.

The results of the treatment of peri-implant mucositis have been shown better therapeutic effect in patients of the main group compared to the control one already on the 3rd day of treatment: after the use of i-PRF in 72.7% of the examined patients, the discomfort in the gums and pain were decreased, bleeding and hyperemia of the gingival margin were not observed. 3 patients were re-injected with i-PRF on the 7th day of treatment. At that time, in the control group on the 3rd day of treatment only in 33.3% of subjects the reduction of inflammation signs was revealed.

On the 7th day in the main group of patients the clinical manifestations corresponded to the norm: the oral mucosa acquired a pale pink color, a tight fit of the gingival tissues to the implant neck was revealed (Figure 4a, 4b). In these patients, low indices of mPI, mGI and mSBI were determined, which indicated a good oral hygiene, the absence or low activity of the inflammatory reaction in the gingival tissue of peri-implant zone.

A similar clinical condition in the control group on the 7th day of treatment was achieved in 66.7% of patients. Complete elimination of inflammation in patients of the control group was diagnosed on the 14th day of observation.

The results of the indexes assessment in patients of the studied groups in different periods of dynamic observation are shown in Table 1. As can be seen from the above data, in patients of both groups an improvement of mPI values on the 3rd, 7th, and 14th days of the examination was revealed, with the exception of the 12-month follow-up period, that are explained by the lack of professional hygiene. A significant decrease of hygiene index values in patients of both groups is explained by the performed professional oral hygiene, as well as the training of individual hygiene, the choosing dental care products and the provided recommendations for hygiene maintain. Worsening of mPl values in a year can be explained by unscrupulous implementation of the dentist's recommendations in the absence of control.

Similar results were observed during the analysis of the mGI: a significant decrease in the values of the index in different periods of observation compared to the baseline. At the same time, in the patients of the main group the values of mGI in a year of

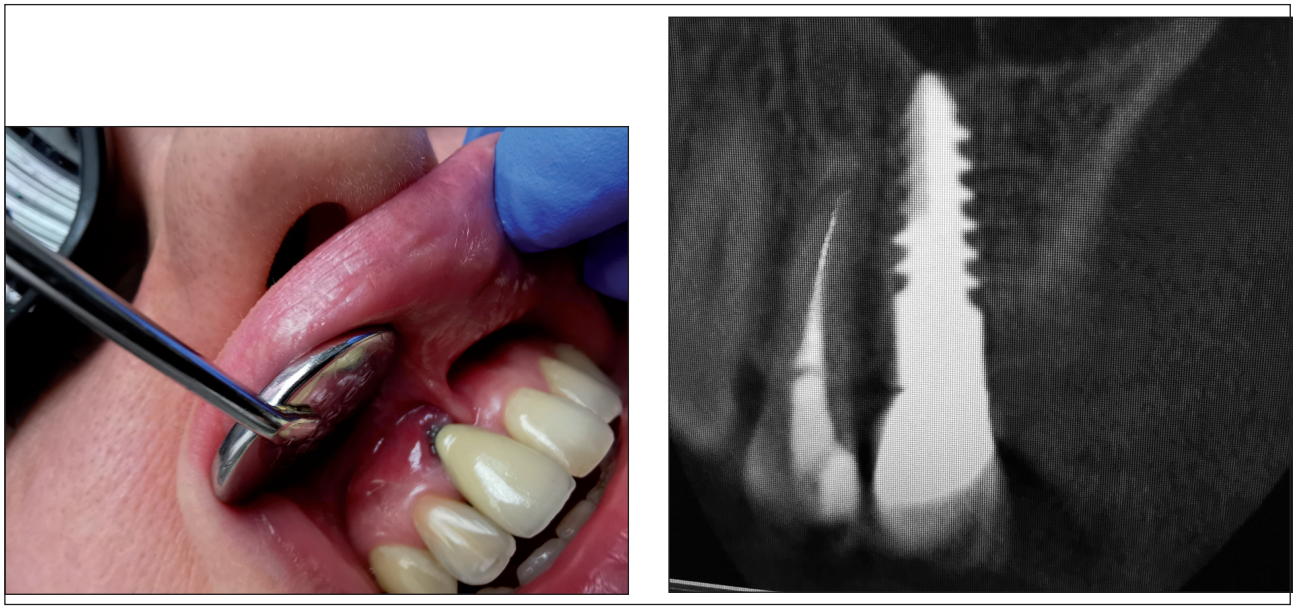

Figure 3a, 3 b. Peri-implant mucositis clinical and radiographic presentation (before treatment)

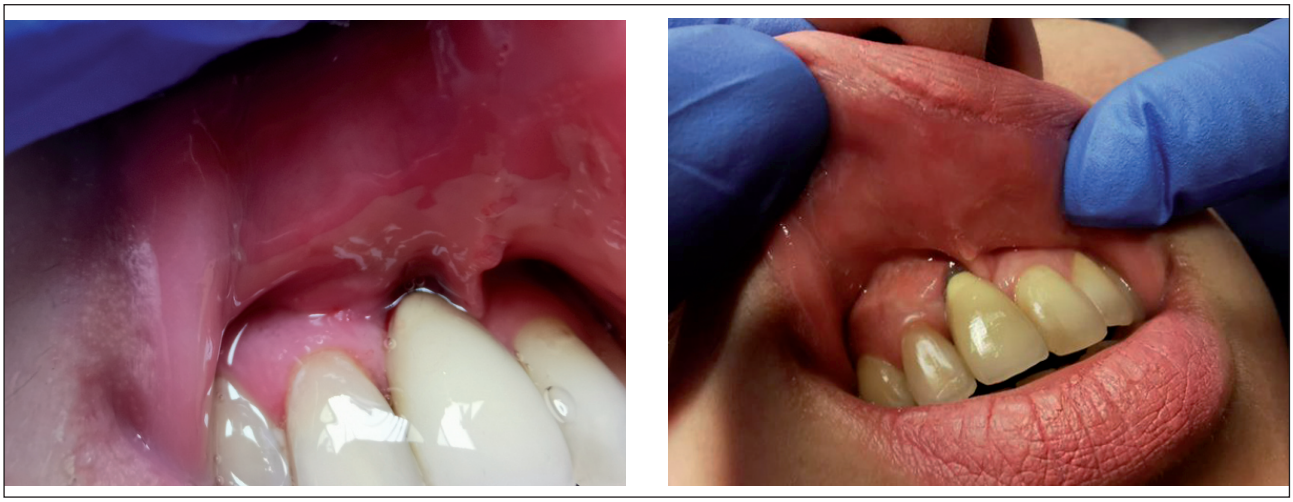

Figure 4a, 4b. Peri-implant mucositis clinical presentation (after treatment)

Table 1. Index assessment of peri-implant tissues condition during mucositis treatment

Indexes	mSBI (scores)		mGI (scores)		mPI (scores)	
Terms of observations	Main group	Control group	Main group	Control group	Main group	Control group
Before treatment	1.64±0.21	1.66±0.20 p_1>0.05	1.36±0.29	1.33±0.20 p_1>0.05	1.73±0.25	1.75±0.23 p_1>0.05
3rd day of treatment	0.64±0.21 p<0.01	0.83±0.28 p<0.05; p_1>0.05	0.45±0.22 p<0.05	0.67±0.23 p<0.05; p_1>0.05	0.36±0.16 p<0.001	0.33±0.15 p<0.001; p_1>0.05
7th day of treatment	0.36±0.16 p<0.001	0.58±0.24 p<0.01; p_1>0.05	0.27±0.15 p<0.01	0.42±0.16 p<0.01; p_1>0.05	0.36±0.21 p<0.001	0.42±0.20 p<0.001; p_1>0.05
14th day of treatment	0.18±0.13 p<0.001	0.33±0.15 p<0.001; p_1>0.05	0.09±0.10 p<0.001	0.17±0.12 p<0.001; p_1>0.05	0.45±0.22 p<0.01	0.67±0.23 p<0.01; p_1>0.05
12 months after treatment	0.55±0.17 p<0.01	1.25±0.23 p>0.05; p_1<0.05	0.36±0.21 p, p_1<0.05	1.08±0.20 p>0.05; p_1<0.05	0.91±0.36 p>0.05	1.17±0.31 p, p_1>0.05

Note: p – the significance of the difference between the index values before treatment and at different periods of dynamic observation; p1 – the significance of the difference between the values of the index of the main and control groups; mSBI: 0 – absent of bleeding, 1– bleeding to isolate spot, 2 – linear bleeding, 3 – spontaneous and profuse bleeding; mGI: 0 – normal mucosa, 1– edema, 2 – edematous and polishes mucosa, 3 – marked redness, edema, spontaneous bleeding; mPI: 0 – absence of plaque, 1– plaque detectable with probe, 2 – visible plaque, 3 – presence of abundant plaque deposits.

observation were significantly lower (0.36 ± 0.21 scores) than in subjects of the control group (1.08 ± 0.20 scores, p_1<0.05).

Bleeding on probing is an important parameter in the diagnosis of mucositis. The tendency of decreasing in the mSBI was observed among patients who participated in the clinical study, that correlated with the results of mPI and mGI. The performed periodontal procedures significantly reduced the values of mSBI. Along with that, the mSBI values were differed among patients of both groups in a year of dynamic observation: in the main group of patients, the values were significantly lower (0.55 ± 0.17 scores) than in the control group (1.25 ± 0.23 scores, p_1<0.05).

When analyzing the results of probing the gingival attachment in patients of the main group, the indicators of the depth of the gingival attachment were not changed in a year of observation, in the control group they were worsened by 0.1 mm (1.2 ± 0.1 mm at baseline up to 1.3 ± 0.2 mm in 12-month follow-up evaluation).

DISCUSSION

I-PRF technology is a technique for obtaining autogenous material from the patient's own blood with a high content of all forms of leukocytes and platelets, which slowly releases growth factors, improving tissue regeneration during treatment [9, 10].

The injectable blood concentrate i-PRF enhances bone metabolism and angiogenesis, possesses anti-inflammatory, osteoinductive and local immunomodulating effects [10, 11]. Platelet-enriched fibrin PRF contains: platelets – 100%, leukocytes – 60%, natural fibrin. Due to intense stimulation of progenitor cells, leukocytes contribute to bone synthesis and cause the transformation of monocytes into macrophages. According to studies [9, 11, 12], platelets and leukocytes can secrete growth factors only after the formation of a fibrin clot, because only fibrin is able to give them therapeutic potential.

When using i-PRF in the complex treatment of peri-implant mucositis, patients of the main group had better therapeutic effect compared to patients of the control group, in which

the standard treatment algorithm was used. Thus, on the 3rd day after the start of the treatment in the patients of the main group the pain and discomfort in the gums were reduced, the bleeding and hyperemia of the gingival margin were decreased, and the serous discharge from the treated areas was stopped. As early as the 7th day of the treatment, it was possible to achieve complete elimination of inflammation in the peri-implantation zone in 81.8% patients. The data of the clinical examination were confirmed by significantly lower values of index assessment of the hygienic and periodontal status of oral cavity compared to baseline.

Under the influence of therapeutic complexes in patients of the control group, positive dynamics of clinical and paraclinical indicators of gum condition around actively functioning orthopedic structures on implants were revealed up to the 7th day of treatment; complete elimination of inflammation was achieved in most patients by the end of the second week.

In general, in the main group of patients the duration of treatment was 7 ± 01 days. The achievement of a similar clinical status in patients of the control group was delayed by 3-4 days. This significant ($p < 0.05$) difference is caused by the drop-by-drop release of growth factors from PRF over 7 days. Due to the long-term release of growth factors, i-PRF promotes rapid regeneration of the gums and bone [11, 12].

The high therapeutic efficiency of i-PRF is confirmed by the results of follow-up observation: the clinical effect obtained immediately after peri-implant mucositis therapy and in 12 months of observation was maintained in a large number of patients of the main group than in the control group by 31,8%.

The use of i-PRF for treatment of mucositis and prevention of peri-implantitis provided a faster regression of clinical symptoms of dental mucositis (for 3-4 days), normalization of indicators of hygienic and periodontal status, long-lasting stabilization of the process (81.8% of patients) than with traditional treatment.

CONCLUSIONS

The use of i-PRF in the complex treatment of peri-implant mucositis contributes to the rapid elimination of inflammation signs and bleeding of the gums surround the implants, accelerates the soft tissues regeneration, shortens treatment times and provides long lasting stabilization of the process.

References

1. Lee CT, Huang YW, Zhu L, Weltman R. Prevalences of peri-implantitis and peri-implant mucositis: systematic review and meta-analysis. J Dent. 2017;62:1-12. doi: 10.1016/j.jdent.2017.04.011.
2. Zitzmann NU, Berglundh T. Definition and prevalence of per-implant diseases. J Clin Periodontol. 2008;35:286-291. doi: 10.1111/j.1600-051X.2008.01274.x.
3. Derks J., Tomasi C. Peri-implant health and disease. A systematic review of current epidemiology. J Clin Periodontol. 2015;42(16):158-171. doi: 10.1111/jcpe.12334.
4. Wada M, Mameno T, Otsuki M et al. Prevalence and risk indicators for peri-implant diseases: A literature review. Japanese Dental Science Review. 2021;57:78-84. doi: 10.1016/j.jdsr.2021.05.002.
5. Mashchenko I, Gudaryan A, Shirinkin S. Modern approaches to complex treatment of dental periimplantitis. J Clin Med Kaz. 2015;4(38):50-55.
6. Figuero E, Graziani F, Sanz Sánchez I et al. Management of peri-implant mucositis and peri-implantitis. Case definitions for peri-implant diseases. Periodontology 2000. 2014;66:255-273.
7. Jepsen S, Berglundh T, Genco R et al. Primary prevention of peri-implantitis: managing peri-implant mucositis. J Clin Periodontol. 2015;42:152-157. doi: 10.1111/jcpe.12369.
8. Salvi G, Ramseier C. Efficacy of patient-administered mechanical and/or chemical plaque control protocols in the management of peri-implant mucositis. A systematic review. J Clin Periodontol. 2015;42(16):187-201. doi: 10.1111/jcpe.12321.
9. Shah R, Shah H, Shetty O, Mistry G. A novel approach to treat periimplantitis with the help of PRF. Pan African Medical J. 2017;27:256. doi: 10.11604/pamj.2017.27.256.12544.
10. Miron RJ, Choukroun Hoboken J. Platelet rich fibrin in regenerative dentistry: biological background and clinical indications. NJ: Wiley. 2017:154.
11. Deeb MA. Role of Platelet-Rich Fibrin (PRF) and Platelet-Rich Plasma (PRP) in Oro-Facial Tissue Regeneration: A Narrative Review. J Advan Oral Research. 2020;11(1):5-11. doi: 10.1177/2320206819895836.
12. Gasparro R, Adamo D, Masucci M et al. Use of injectable PRF (platelet-rich fibrin) in the treatment of plasma cell mucositis of the oral cavity refractory to corticosteroid therapy: a case report. Dermatol Ther. 2019;32:e13062. doi: 10.1111/dth.13062.

The work is a fragment of the research project "Modern trends and latest technologies in the diagnosis and treatment of odontopathology, diseases of periodontal tissues and oral mucous membrane", state registration № 0118U005471.

Conflict of interest:
The Authors declare no conflict of interest

Received: 11.03.2022
Accepted: 24.08.2022

ADDRESS FOR CORRESPONDENCE:
Nataliia G. Gadzhula
National Pirogov Memorial Medical University
56 Pyrohov St., 21018 Vinnytsia, Ukraine
phone: +380977011918
e-mail: gadzhula@vnmu.edu.ua

ORCID ID and AUTHORS CONTRIBUTION
0000-0003-0016-2264 – Nataliia G. Gadzhula (A, D, F)
0000-0003-4454-9161 – Maryna A. Gorai (A, B)
0000-0002-8259-9963 – Larysa F. Kurdysh (B, C)
0000-0002-8904-1639 – Olha Yu. Pylypiuk (E)
0000-0002-6799-9627 – Anastasiia V. Povsheniuk (E)

A – Research concept and design, B – Collection and/or assembly of data,C – Data analysis and interpretation, D – Writing the article, E – Critical review of the article, F – Final approval of article