Research Article

Clinical Manifestations of Periodontal Tissue Diseases in Patients with Rheumatoid Arthritis Who Live in Anthropogenically Loaded Areas

Khristina Kovalyshyn[*], Mykola Rozhko

Abstract

The **objective** of the study is to clinically assess the condition of periodontal tissues in patients with rheumatoid arthritis, living in anthropogenically loaded and environmentally friendly areas and in people with generalized periodontitis without concomitant somatic diseases.

Materials and methods. There were examined 137 patients, including 82 patients with generalized periodontitis of the I degree (subgroups A) and the II degree (subgroups B) with rheumatoid arthritis, living in anthropogenically loaded areas (group I), environmentally friendly areas (group II) and without concomitant somatic diseases living in environmentally friendly areas (group III). Control group – included 18 healthy people.
Periodontal tissues were evaluated according to the indices: Greene-Vermillion, PMA, periodontal index offered by Russel and the depth of periodontal pockets.

Results. Women (80%) dominated in each group, patients with generalized periodontitis of the II degree of severity dominated, too.
The highest depth of periodontal pockets was 5.02 ± 0.11 mm in the IB subgroup and differed significantly from this figure in the IIB subgroup 1.07-fold ($p_{IB-IIB} < 0.05$) and from that in the IIIB subgroup 1.2-fold ($p_{IB-IIIB} < 0.001$). The value of the Greene-Vermilion index in patients with GP of the I degree of development in all subgroups A corresponded to "unsatisfactory". In patients with GP of the II degree of development, the state of hygiene corresponded to "bad" in subgroups IB, IIB and was 3.04 ± 0.11 points ($p_{IB-IIB}<0.01$, $p_{IB-IIIB}<0.001$, $p_{IB-K}<0.001$); $2,63 \pm 0.07$ points ($p_{IIB-IB}<0.01$, $p_{IIB-IIIB}<0.001$, $p_{IIB-K}<0.001$), in IIIB – "unsatisfactory". According to the indicators of the PMA index in patients with GP of the I degree of severity, we've found the average severity degree of gingivitis (within the range of $43.25 \pm 2.02 – 48.06 \pm 1.46\%$) and severe degree of gingivitis in patients with the GP of the II degree > 50 %. The highest indicator of periodontal index was found in the IB subgroup – 6.16 ± 0.10 points ($p_{IB-IIB}<0.01$, $p_{IB-IIIB}<0.001$, $p_{IB-K}<0.001$), which indicated a severe form of periodontitis.

Conclusion. Most often, GP in patients with RA was diagnosed in women, most of whom were patients with GP of the II degree (most in group I – 69.04%). The highest depth of periodontal pockets was 5.02 ± 0.11 mm in the IB subgroup. The performed clinical and index assessment of periodontal tissues in patients of three groups indicates a more severe course of GP of the I and II degree in patients with rheumatoid arthritis living in anthropogenically loaded areas (IA, IB subgroups).

Keywords

periodontium; generalized periodontitis; rheumatoid arthritis; anthropogenically loaded areas

Ivano-Frankivsk National Medical University, Ukraine
*Corresponding author: endodoc89@gmail.com

Problem statement and analysis of the latest research

One of the most common periodontal tissue diseases is generalized periodontitis (GP) – a multifactorial disease, as in its occurrence and development a number of exogenous and endogenous factors are involved [11]. It is proved that patients with rheumatoid arthritis (RA) have the prerequisites for the rapid development and progression of GP [2, 3, 10]. Since this somatic pathology is complicated by osteoporotic process, it causes a violation of the processes of resorption and formation of bone tissue [16, 17, 18, 19, 20].

Recently, there are many researches that show the negative impact of the environmental situation on the peculiarities of the course of GP and RA, caused by chemical and physical anthropogenic environmental incentives [12, 14, 1]. An increase in periodontal parameters was found in patients who live in ecologically polluted areas [6].

Taking into account that the course of periodontal disease is closely related to the adverse effects of the environment and the general somatic condition of the body, it is extremely important to study the development, the course of GP in RA patients who live in anthropogenically loaded areas.

The objective of the research is the clinical assessment of periodontal tissues in patients with rheumatoid arthritis living in environmentally favorable and anthropogenically loaded areas and in persons with generalized periodontitis without concomitant somatic diseases.

1. Materials and Methods

A dental examination of 137 patients aged 23 to 57 years was performed. Among them, 82 patients with RA are in remission with GP. The diagnosis of RA was determined by a rheumatologist on the basis of clinical, laboratory and radiological data according to the unified clinical protocol "Rheumatoid Arthritis", approved by the Order of the Ministry of Health of Ukraine #263 dated 11 April 2014. Treatment prescribed by a rheumatologist consisted of the use of basic anti-rheumatic drugs and nonsteroidal anti-inflammatory drugs.

To study the peculiarities of the clinical course of GP in patients with RA, depending on the place of residence, there were formed two groups. Group I (42 patients), who live in ecologically polluted areas, included residents of the Kalush district of Ivano-Frankivsk region, which has the status of a "zone of ecological emergency" [5, 13]. Group II (40 patients) consisted of patients with RA – residents of Ivano-Frankivsk. In parallel, there were examined 37 patients with GP without concomitant somatic pathology, who were included into Group III. The control group consisted of individuals with intact periodontium, without concomitant somatic diseases (18 patients). All individuals were maximally standardized in terms of age and gender characteristics.

Further clinical researches included patients with GP of the I and II degree of severity. Respectively, each group depending on the stage of GP, was divided into two subgroups: A – patients with GP of the I degree and B – patients with GP of the II degree.

Dental examination of patients was performed according to generally accepted methods with the outpatient medical card recording of a dental patient and an individual examination card developed by us. Clinical examination of patients began with the collection of medical history and life, complaints and assessment of general somatic condition. The survey drew attention to the duration of the disease GP and RA.

The level of oral hygiene was investigated using a simplified Greene-Vermillion index. To assess the inflammatory process in the gums' area there was used the PMA index in the Parma modification (papillary-marginal-alveolar). Dystrophic-inflammatory changes in periodontal tissues were assessed by the periodontal index (PI) offered by Russel. In order to determine the degree of bone tissue destruction and the amount of retraction of the gums, the depth of periodontal pockets was measured using a periodontal probe on four sides of the tooth: vestibular, oral, medial and distal by direct and indirect methods. The diagnosis of periodontal disease was determined according to the classification by MF Danylevskyy (1994).

Statistical processing of the obtained results was performed by the method of variation statistics using the application package of the computer program of medical and statistical calculations STATISTICA 7.

The presented work was performed within the research work of the Department of Dentistry of ESIPE IFNMU "Optimization of treatment and prevention measures to reduce the level of dental morbidity of the rural population of Prykarpattia, who live in anthropogenically loaded areas" (# DR 0117U000946).

2. Results

Among 137 patients in each of the examined groups, women dominated, but most of them were in group I – 85.71% and the least in the control group – 66.67% (Fig. 1).
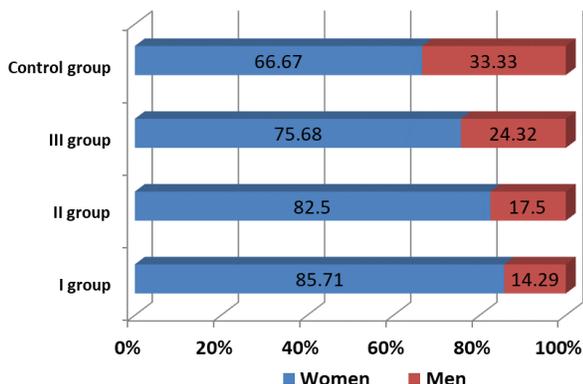

Figure 1. Distribution of examined patients according to gender.

The next phase of our research was to study the ratio of patients in all groups according to the severity of GP. The results obtained by us are represented in Fig. 2.

Patients with an initial degree of severity of GP among the examined by us were not revealed. As can be seen from Fig. 2, GP of the I degree of development was most often diagnosed in patients of the group III – 13 people (35.13%), and the least patients with the I degree were in the group I – 6 (14.28%). In the group II the GP of the I degree was found in 9 (22.50%) patients.
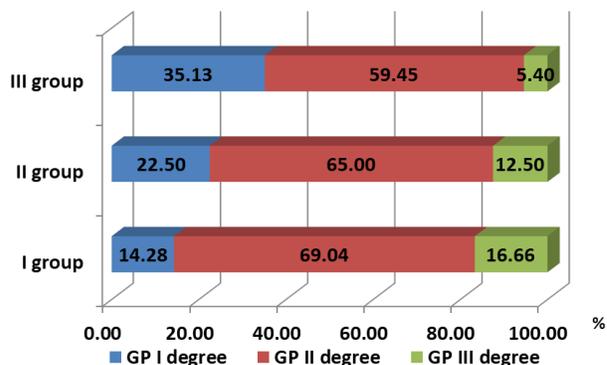

Figure 2. Distribution of the examined patients according to the severity of GP.

Patients with GP of the II degree of development were 29 (69.04%) in the group I, 26 (65%) in the group II and 22 (59.45%) in the group III. Thus, in each of the groups patients with GP of the II degree of severity prevailed.

The III degree of development of GP in the group I was most revealed – 7 (16.66%) patients, which indicates a significant progression of dystrophic-inflammatory changes in periodontal tissues. On the other hand, among patients of the group II of persons with the III degree of GP there were less – 5 (12.50%), and in the group III only – 2 (5.40%) patients.

Concomitant somatic pathology and adverse effects of environmental factors lead to an increase in the severity of GP in patients with RA who live in environmentally unfavorable areas.

The course of GP of the I and II degree of severity was characterized by a variety of clinical manifestations and complaints of patients, which are listed in Table 1.

In case of GP combined with RA with adverse environmental influences (group I) and patients with RA (group II), complained of bleeding gums, teeth mobility. Patients often noted the increased sensitivity of the teeth to chemical, thermal and mechanical stimuli and pain in the gums when eating.

Patients with GP, without concomitant somatic pathology (group III) mostly complained of discomfort in the gums, food impaction in the interdental spaces, bad breath.

Table 1. Complaints of patients with generalized periodontitis of the I-II degree

Groups	Subgroups	Discomfort in the gums' area		Gum pain		Bleeding gums		Teeth mobility		Hyper-sensitivity of the teeth		Bad breath	
		abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
I	A (n=6)	2	33.33	4	66.66	5	83.33	1	16.66	2	33.3	2	33.33
	B (n=29)	6	20.68	23	79.31	26	89.65	23	79.31	24	82.75	25	86.20
II	A (n=9)	5	55.55	4	44.44	7	77.77	1	11.11	1	11.11	2	22.22
	B (n=26)	10	38.46	17	65.38	22	84.61	18	69.23	19	73.07	19	73.07
III	A (n=13)	11	84.61	4	30.76	6	46.15	0	0	1	9.09	3	23.07
	B (n=22)	9	40.90	13	59.09	15	68.18	11	50	13	59.09	13	59.09

Table 2. Index characteristics of periodontal tissues in the examined patients (M±m)

Indicators	Almost healthy	I group		II group		III group	
	K (n=18)	IA (n=6)	IB (n=29)	IIA (n=9)	IIB (n=26)	IIIA (n=13)	IIIB (n=22)
Hygiene index according to Greene-Vermillion (points)	1.14 ±0.04	2.47±0.13 $p_{IA-IIA}<0.05$ $p_{IA-IIIA}<0.01$ $p_{IA-K}<0.001$	3.04±0.11 $p_{IB-IIB}<0.01$ $p_{IB-IIIB}<0.001$ $p_{IB-K}<0.001$	2.12±0.04 $p_{IIA-IA}<0.05$ $p_{IIA-IIIA}>0.05$ $p_{IIA-K}<0.001$	2.63±0.07 $p_{IIB-IB}<0.01$ $p_{IIB-IIIB}<0.001$ $p_{IIB-K}<0.001$	1.99±0.06 $p_{IIIA-IA}<0.05$ $p_{IIIA-IIA}>0.05$ $p_{IIIA-K}<0.001$	2.33±0.05 $p_{IIIB-IB}<0.001$ $p_{IIIB-IIB}<0.001$ $p_{IIIB-K}<0.001$
PMA (%)	3.90 ±0.41	48.06±1.46 $p_{IA-IIA}>0.05$ $p_{IA-IIIA}>0.05$ $p_{IA-K}<0.001$	58.37±0.83 $p_{IB-IIB}<0.001$ $p_{IB-IIIB}<0.001$ $p_{IB-K}<0.001$	45.04±1.77 $p_{IIA-IA}>0.05$ $p_{IIA-IIIA}>0.05$ $p_{IIA-K}<0.001$	54.46±0.72 $p_{IIB-IB}<0.001$ $p_{IIB-IIIB}>0.05$ $p_{IIB-K}<0.001$	43.25±2.02 $p_{IIIA-IA}>0.05$ $p_{IIIA-IIA}>0.05$ $p_{IIIA-K}<0.001$	52.55±0.73 $p_{IIIB-IB}<0.001$ $p_{IIIB-IIB}>0.05$ $p_{IIIB-K}<0.001$
PI according to Russel (points)	0.13 ±0.01	4.06±0.06 $p_{IA-IIA}<0.01$ $p_{IA-IIIA}<0.001$ $p_{IA-K}<0.001$	6.16±0.10 $p_{IB-IIB}<0.01$ $p_{IB-IIIB}<0.001$ $p_{IB-K}<0.001$	3.84±0.04 $p_{IIA-IA}<0.01$ $p_{IIA-IIIA}<0.01$ $p_{IIA-K}<0.001$	5.73±0.09 $p_{IIB-IB}<0.01$ $p_{IIB-IIIB}<0.001$ $p_{IIB-K}<0.001$	3.18±0.19 $p_{IIIA-IA}<0.01$ $p_{IIIA-IIA}<0.01$ $p_{IIIA-K}<0.001$	4.43±0.09 $p_{IIIB-IB}<0.01$ $p_{IIIB-IIB}<0.001$ $p_{IIIB-K}<0.001$

Only a few patients noted hypersensitivity to chemical, thermal and mechanical stimuli. The severity of these symptoms depended on the degree of development of GP and prevailed in patients with the II stage of GP, especially in subgroup IB.

The obtained results of the hygienic condition of the oral cavity and index assessment of periodontal tissues in patients with GP are given in Table 2.

During the analysis of the results obtained by us, it was found that the value of the Greene-Vermillion index in patients with GP of the I degree of development in all A subgroups corresponded to the level of oral hygiene "unsatisfactory". The highest indicator was 2.47 ± 0.13 points in IA subgroup and significantly differed from IIA subgroup 1.16-fold,

IIIA – 1.24-fold and control group 2.16-fold. Also, "unsatisfactory" state of oral hygiene was found in patients with GP of the II degree of development in IIIB subgroup and was 2.33 ± 0.05 points, significantly differed from the control group 2.04-fold.

In patients with GP of the II degree of development in subgroups IB and IIB the state of hygiene corresponded to "bad" and was 3.04 ± 0.11 points and 2.63 ± 0.07 points, which was 2.65- and 2.29-fold significantly differed from the control group, respectively. Analysis of the Greene-Vermillion index showed that in the case of deepening of the pathological process in the periodontal tissues, there is a deterioration of the oral hygiene.

Inflammatory changes (symptomatic gingivitis

of various clinical and morphological forms) were assessed using the PMA index. In patients with GP of the I degree we found the average severity of gingivitis: IA – $48.06 \pm 1.46\%$, IIA – $45.04 \pm 1.77\%$ and IIIA – $43.25 \pm 2.02\%$, which were not reliable among themselves. And in patients with GP of the II degree we've found a severe degree of gingivitis: IB – $58.37 \pm 0.83\%$, IIB – $54.46 \pm 0.72\%$ and IIIB – $52.55 \pm 0.73\%$, and were also unreliable among themselves. The evaluation showed that the results obtained by us in the three groups of all subgroups significantly differed from the results of the PMA index in the control group, which amounted to $3.90 \pm 0.41\%$.

The analysis of the data obtained by us, of the average value of PI according to Russel in patients with GP of various degrees differed significantly from the results of this indicator in the control group, which was 0.13 ± 0.01 points. The average severity of periodontitis was found in patients with the I degree of GP development, PI index was in the IA subgroup – 4.06 ± 0.06 points, IIA – 3.84 ± 0.04 points and IIIA – 3.18 ± 0.19 points and in patients of IIIB subgroup with the II degree of GP development – 4.43 ± 0.09 points (Table 2).

Severe periodontitis was detected in patients with II degree of GP, the PI index was in the IB subgroup – 6.16 ± 0.10 points and in IIB – 5.73 ± 0.09 points (Table 2). The growth of this index in IB and IIB subgroups indicates the activation of destructive processes in the cellular process of the upper jaw and the cellular part of the lower jaw.

Analyzing the results of measuring the depth of periodontal pockets in patients of all groups also revealed a dependence on the degree of development of periodontal disease (Fig. 3). The average value of the depth of periodontal pockets in patients with GP of the I degree in the three subgroups were close in value and differed insignificantly, in particular IA – 3.54 ± 0.10 mm, IIA – 3.42 ± 0.05 mm and IIIA – 3.31 ± 0.06 mm, respectively (Table 2).

In the GP of the II degree the highest indicator was 5.02 ± 0.11 mm in IB subgroup and significantly differed from this indicator in IIB subgroup 1.07-fold and from that in IIIB subgroup 1.2-fold (Table 2).
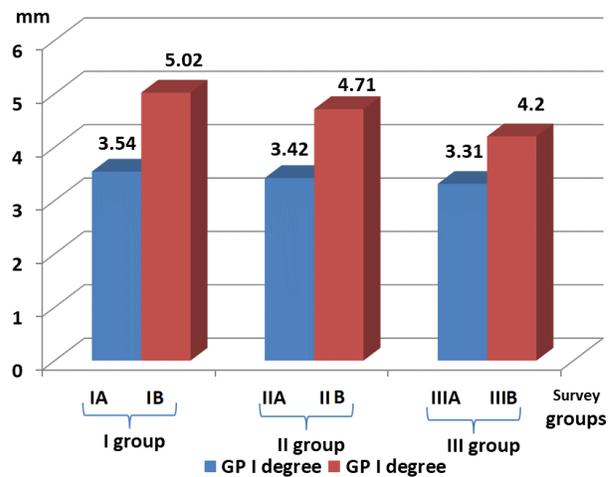

Figure 3. Depth of periodontal pockets in patients of the groups I, II and III.
Note: $p_{IA-IIA} > 0.05$; $p_{IA-IIIA} > 0.05$; $p_{IIA-IIIA} > 0.05$; $p_{IB-IIB} < 0.05$; $p_{IB-IIIB} < 0.001$; $p_{IIB-IIIB} < 0.001$.

3. Discussion

When comparing the depth of periodontal pockets in patients with GP of the I degree, our results were the highest in the IA subgroup – 3.54 ± 0.10 mm are consistent with the results of OL Lychkovska – 3.51 ± 0.1 mm [9], slightly higher than the results of IZ Chubiy – 2.52 ± 0.56 mm [15]. In the GP of the II degree the highest indicator was 5.02 ± 0.11 mm in the IB subgroup, which was consistent with the results of TI Vivcharenko – 3-5 mm [4] and slightly higher than the indicators of OL Lychkovska 4.05 ± 0.08 mm [9].

The result obtained by us, of the Greene-Vermillion hygiene index was assessed as "bad" condition of the oral hygiene in the II degree of GP in IB and IIB subgroups was 3.04 ± 0.11 and 2.63 ± 0.07 points, as according to the results of TI Vivcharenko in the GP, which occurs against the background of arterial hypertension 3.1 ± 0.13 points [4], VT Dyryk – 3.05 ± 0.14 points [6]. Slightly exceeded the indicators of IZ Chubiy – 2.83 ± 0.31 points [15] and OV Dovhanych – 2.20 ± 0.03 points [7], OL Lychkovska – 2.04 ± 0.28 points [9] and MS Zaliznyak – 1.53 ± 0.04 points [8].

The highest percentage of PMA index was also observed in the IB subgroup and was $55.80 \pm 0.99\%$. The results were consistent with the work of VT

Dyryk, which revealed the impact of harmful working conditions on the PMA index, which was 55.77% and slightly less than the result in the work of IZ Chubiy – $60.22 \pm 14.0\%$ [15], which was determined in patients with GP who live in environmentally unfavorable areas. At the same time, the results obtained by us differed significantly from the results obtained in the works of MS Zalizniak – $33.4 \pm 1.1\%$ [8] and OV Dovhanych – 27.20% [7]. Thus, we can assume that the severity of the inflammatory process in periodontal tissues is affected by an environmentally unfavorable situation.

According to our data, the values of PI were the highest in GP of the I degree in IA subgroup 4.06 ± 0.06 points and in GP of the II degree in IB subgroup – 6.16 ± 0.10 points. Our results are consistent with the results of IZ Chubiy – 3.79 ± 0.68 points – GP of the I degree and 6.81 ± 0.99 points [15], however, significantly exceeded the results of OV Dovhanych – 3.29 ± 0.04 points [7].

4. Prospects of Further Researches

The obtained results of index assessment of periodontal tissues in patients with rheumatoid arthritis who live in anthropogenically loaded areas, serve as a criterion for assessing the severity of the GP and will be used in the future to develop a treatment and prevention complex.

5. Conclusions

The frequency of detection of GP in patients with RA was diagnosed in the female population. In all examined groups, the majority were patients with GP of the II degree, in particular, the largest share in the group I was 69.04%. The highest depth of periodontal pockets was 5.02 ± 0.11 mm in the IB subgroup and differed significantly from this index in the IIB subgroup 1.07-fold and from that in the IIIB subgroup 1.2-fold. The conducted clinical and index assessment of periodontal tissues in patients of three groups indicates a more severe course of GP of the I and II degree in patients with rheumatoid arthritis who live in anthropogenically loaded areas (IA, IB subgroups) compared with patients with rheumatoid arthritis living in ecologically favourable areas (IIA, IIB subgroups), and with patients with generalized periodontitis without concomitant somatic pathology living in environmentally favorable areas (IIIA, IIIB subgroups).

Conflict of Interest

The authors stated no conflict of interest.

References

[1] Agaeva DF. The influence of harmful chemical impurities of air on some indicators of the state of the oral cavity. Hygiene and sanitation. 2011; 2: 48-51.

[2] Bilozetsky II, Hrymalyuk NV, Slaba US, Zarudna OI, Makhovska OS, Lehka LL and others. Frequency and features of periodontal disease in patients with rheumatoid arthritis. Galician Medical Journal. 2014; 4: 6-9.

[3] Bilozetsky II. Modern ideas about the relationship between generalized periodontitis, rheumatoid arthritis and osteoporosis. Problems of osteology. 2015; 2 (8): 51-63.

[4] Vivcharenko TI, Rozhko MM. Assessment of periodontal tissue in patients with generalized periodontitis and hypertension. Galician Medical Journal. 2017; 24 (2): 13-5. DOI: `https://doi.org/10.21802/gmj.2017.2.10`

[5] Haydin AM, Dyakiv VO, Chikova IV. Environmental problems of mining and industrial complexes. Scientific-technical journal. 2014 (10): 101-107.

[6] Dyryk VT. The structure of periodontal tissue diseases in workers of agro-industrial production in open and closed ground. Ukrainian Dental Almanac. 2015; 3: 14-18.

[7] Dovhanych OV. Singlet-oxygen therapy in complex treatment in patients with generalized periodontitis. Galician Medical Journal. 2015; 22 (1): 25-27.

[8] Zaliznyak MS. Periodontal status of patients with osteoarthritis. Ukrainian Dental Almanac. 2014; 2: 16-18.

[9] Lychkovska OL, Melnychuk HM. Influence of complex treatment with the use of photodynamotherapy on the condition of periodontal tissues in patients with generalized periodontitis. World of Medicine and Biology 2014; 44 (2): 54-57.

[10] Mazur IP. Disorders of bone metabolism in patients with generalized periodontitis. Implantology. Periodontology. Osteology. 2012; 1: 70-88.

[11] Malyy DU, Antonenko MJ. Epidemiology of periodontal diseases: age aspect. Ukrainian scientific and medical youth journal. 2013; 4: 41-43.

[12] Popovych ZB, Rozhko MM, Solovey SI, Bodnaruk YuB, Kukurudz NI. Environmental problems and the state of dental health in Ivano-Frankivsk region. Preventive pediatric dentistry. 2014; 1: 74-77.

[13] Savchuk LYa, Semchuk YaM. Sources of ecological danger of chemical enterprises of Kalush. Scientific-technical journal. 2014; 2 (10): 107-113.

[14] Sinyachenko OV, Petrenko EA, Naumenko NV, Gonchar GA, Yakovlenko AY. Dependence of the prevalence of rheumatoid arthritis on environmental factors. Ukrainian Journal of Rheumatology. 2012; 47 (1): 87-91.

[15] Chubiy IZ, Rozhko MM. Cytomorphometric characteristics of the condition of periodontal tissues when using the drug quercetin in combination with laser irradiation. Galician Medical Journal. 2015; 4: 82-85.

[16] Carmona L, Cross M, Williams B, Lassere M, March L. Rheumatoid arthritis. Best Pract Res Clin Rheumatol [Internet]. 2010 Dec;24(6):733–45. DOI: https://doi.org/10.1016/j.berh.2010.10.001 [PMid:21665122]

[17] Fernandez-Solari J, Barrionuevo P, Mastronardi CA. Periodontal disease and its systemic associated diseases. Mediators of inflammation. 2015: 153074. DOI: https://doi.org/10.1155/2015/153074 [PMid:26346469 PMCid:PMC4539498]

[18] Markatseli TE, Papagoras C, Drosos AA. Prognostic factors for erosive rheumatoid arthritis. Clin. Exp. Rheumatol. 2010; 28 (1): 114-123.

[19] Rajkarnikar J, Thomas BS, Rao SK. Inter-Relationship Between Rheumatoid Arthritis and Periodontitis. Kathmandu University Medical Journal. 2013; 41 (1): 22-26. DOI: https://doi.org/10.3126/kumj.v11i1.11018 [PMid:23774408]

[20] Winning L, Linden GJ. Periodontitis and systemic disease: association or causality? Curr Oral Health Rep. 2017; 4 (1): 1-7. DOI: https://doi.org/10.1007/s40496-017-0121-7 [PMid:28303212 PMCid:PMC5332497]