

**Dispersion analysis of pathogenic mechanisms of microcirculatory dysfunctions
in case of periodontitis**

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Summary: The dispersion analysis identified that disorders in erythrocytes cytoarchitectonic, plasma & cell homeostasis indices and LPO (lipids peroxide oxidation) potency have a pathogenic impact on the reduction of parodontium microcirculation. The impact of considered factors on microcirculation dysfunction made 82.82% in case of MGP (mild generalized periodontitis), 79.92% in case of ModGP (moderate generalized periodontitis) and 98.94% in case of SGP (severe generalized periodontitis). Impact intensity of separately considered factors is high and significant: 26.60-29.68% for erythrocytes cytoarchitectonic; 16.34-24.09% for thrombocytes; 16.58-26.57% for fibrinogen and 14.35-20.18% for LPO.

Key words: *periodontitis, dispersion analysis, erythrocyte, thrombocyte, fibrinogen, homeostasis, microcirculation.*

Microcirculation dysfunctions mean stereotyped sign of abnormalities in organs and heart-vascular system tissues, where the challenge of blood circulation – histological homeostasis [1.4], is realized. A number of specific rheological effects, which have to be revealed for microcirculation diagnostic, appears in microcirculatory bloodstream due to blood corpuscular features. [2,3,5,6,7].

Evaluation of effectiveness and focus of factors impact on the result is possible using the dispersion analysis [8]. According to abovementioned, the purpose of the research is to conduct the dispersion analysis of the most significant pathogenic mechanisms causing microcirculatory dysfunctions in case of periodontitis.

Materials and methods

25 patients with mild generalized periodontitis, 25 patients with moderate generalized periodontitis and 25 patients with severe generalized periodontitis, randomized according to sex, age and severity of baseline somatic pathology, were involved into the dispersion analysis.

The impact of 4 factors on microcirculation level:

A – level of blood cells;

B – level of blood plasma hemostasis indices;

C – erythrocytes status;

D - values of LPO-AS system.

Values, which are the most significantly ($r < 0.05$) associated with microcirculation value have been chosen for dispersion analysis. Coagulation cellular indices were measured using platelet adhesiveness value; plasma values were measured using blood fibrinogen value; erythrocytes status was assessed using erythrocytes aggregation value; LPO values were evaluated using MD value.

The gradation, considering its shifting factor from a mean value in the observation group, was adopted to each factor: shifting to 1 – 10.0%; shifting to 2 – 11-20% and shifting to 3 – 21% and more. Screen form of matrix observations was made on the basis of chosen gradations. Corresponding microcirculation index is taken as “j” value.

The intensity of controlled factors impact on the microcirculation value was measured by the deviance value in the group.

$$100 \times SS$$

$K_j = \frac{\quad}{\quad}$, where

$$\Sigma SS_1$$

K_j is the intensity of impact on the microcirculation value, %;

SS_1 – microcirculation deviance due to “j” factor impact;

SS – total microcirculation deviance due to the impact of all controlled, non-controlled, random factors and measuring errors.

Significance of factors impact on the microcirculation value was assessed according to F-Fisher criteria. Effects equal or making more than 0.05 (significance value $P < 0.05$) [8] were considered as significant. Results statistical processing was done by Statistika 6.0 Software.

Results and discussions

According to the dispersion value, linear effects of chosen factors to microcirculation value are significant ($P < 0.01$) (table). Patients with SGP had higher possibility ($P < 10^{-8}$). Probably it was due to the highest increase of all factors impact intensity and microcirculation maximal deterioration in case of severe periodontitis.

Screen form of dispersion analysis results

Factor	SS	Degree of freedom	MS	F	P
MGP (mild generalized periodontitis)					
1	4.07	2	2.04	10.3	0.0013
2	3.04	2	1.52	7.72	0.0045
3	5.44	2	2.72	13.80	0.0003
4	2.63	2	1.31	6.67	0.0078
Error	3.15	16	0.20		
ModGP (moderate generalized periodontitis)					
1	2.31	2	1.15	6.49	0.0086
2	2.98	2	1.49	8.37	0.0032
3	3.76	2	1.88	10.58	0.0012
4	2.25	2	1.13	6.35	0.0093
Error	2.84	16	0.17		
SGP (severe generalized periodontitis)					
1	4.99	2	2.50	173.08	-08
2	5.50	2	2.75	190.66	-08
3	5.82	2	2.91	201.70	-09
4	4.18	2	2.09	144.85	-07
Error	0.22	16	0.014		

Microcirculation deviance due to controlled factors makes 82.82% in case of MGP (mild generalized periodontitis); 79.92% in case of ModGP (moderate generalized periodontitis) and 98.94% in case of SGP (severe generalized periodontitis). In such a case, the specific intensity of other factors impact makes 17.18%; 20.08% and 1.06%, correspondingly. During analysis of separate factors, it was established that erythrocyte aggregation made 29.68%; 26.60% and 28.10% correspondingly for patients with MGP (mild generalized periodontitis), ModGP (moderate generalized periodontitis) and SGP (severe generalized periodontitis); corresponding contribution of platelet adhesiveness index made 22.2%; 16.34% and 24.09%; fibrinogen level – 16.58%; 21.07% and 26.57% and MD level – 14.35%; 15.91% and 20.18%, correspondingly.

Intensity of factors impact on microcirculation

GP	Factors					
	Non-controlled	Controlled	Thrombocytes	Fibrinogen	Erythrocytes	MD
MGP	17.18	82.82	22.20	16.58	29.68	14.35
ModGP	20.08	79.92	16.34	21.07	26.60	15.91
SGP	1.06	98.94	24.09	26.57	28.10	20.18

It is necessary to note that the intensity of all studied factors impact was high and significant: erythrocytes cytoarchetictonic dysfunctions contribution varied within the limits of 26.60-29.68%; thrombocytes activity increase made 16.34-24.09%; fibrinogen and LPO processes increase made 16.58-26.57% and 14.35-20.18%, correspondingly.

The table demonstrates microcirculation mean value, deviation from mean values, standard errors and factor occurrence frequency at periodontitis of different severity. Microcirculation index is decreased, when the intensity of all factors impact is increased. Refer to the Figure for an obvious change of

microcirculation mean values associated with various factors. The largest range of mean values for erythrocytes agglomeration value proves its high efficiency to microcirculation inactivation.

The largest range of mean values for erythrocytes agglomeration value (15.07-13.28 MGP; 12.81-11.75 ModGP and 11.0-9.73 SGP) proves its high efficiency to microcirculation.

It shall be noted that other factors caused the reduction of paradontium microcirculation. So, the range of mean values for thrombocytes functional activity made 14.67-13.81; 12.7-11.94 and 11.04-9.77; fibrinogen level – 14.77-13.91; 12.79-11.91 and 10.99-9.76; MD level 14.92-13.63; 12.76-11.98 and 10.36-9.78, correspondingly in case of MGP (mild generalized periodontitis), ModGP (moderate generalized periodontitis) and SGP (severe generalized periodontitis) (refer to Figure).

It is obvious that blood clotting ability process, its rheological characteristics and lipid peroxidation processes cohesion appear mainly at microcirculation zone. Microcirculation dysfunctions are closely accompanied by clotting. Understanding of realization mechanisms and rules of clinical hemorheology, cellular cytoarcheticionics and processes of lipid peroxidation ensured the evaluation of pathogenic mechanisms of microcirculatory dysfunctions formation in case of paradontium pathology progression.

Dispersion analysis provided the opportunity to evaluate the relation of microcirculation dysfunctions to core factors impacting on the intensity of metabolic-trophic disturbances, hemostasis processes and cellular cytoarcheticionics dysfunctions.

Pathogenic significance and the intensity of impact on microcirculatory dysfunctions of erythrocytes functional-morphologic parameters, plasmatic indexes and cellular homeostasis and activation of peroxidation processes were defined.

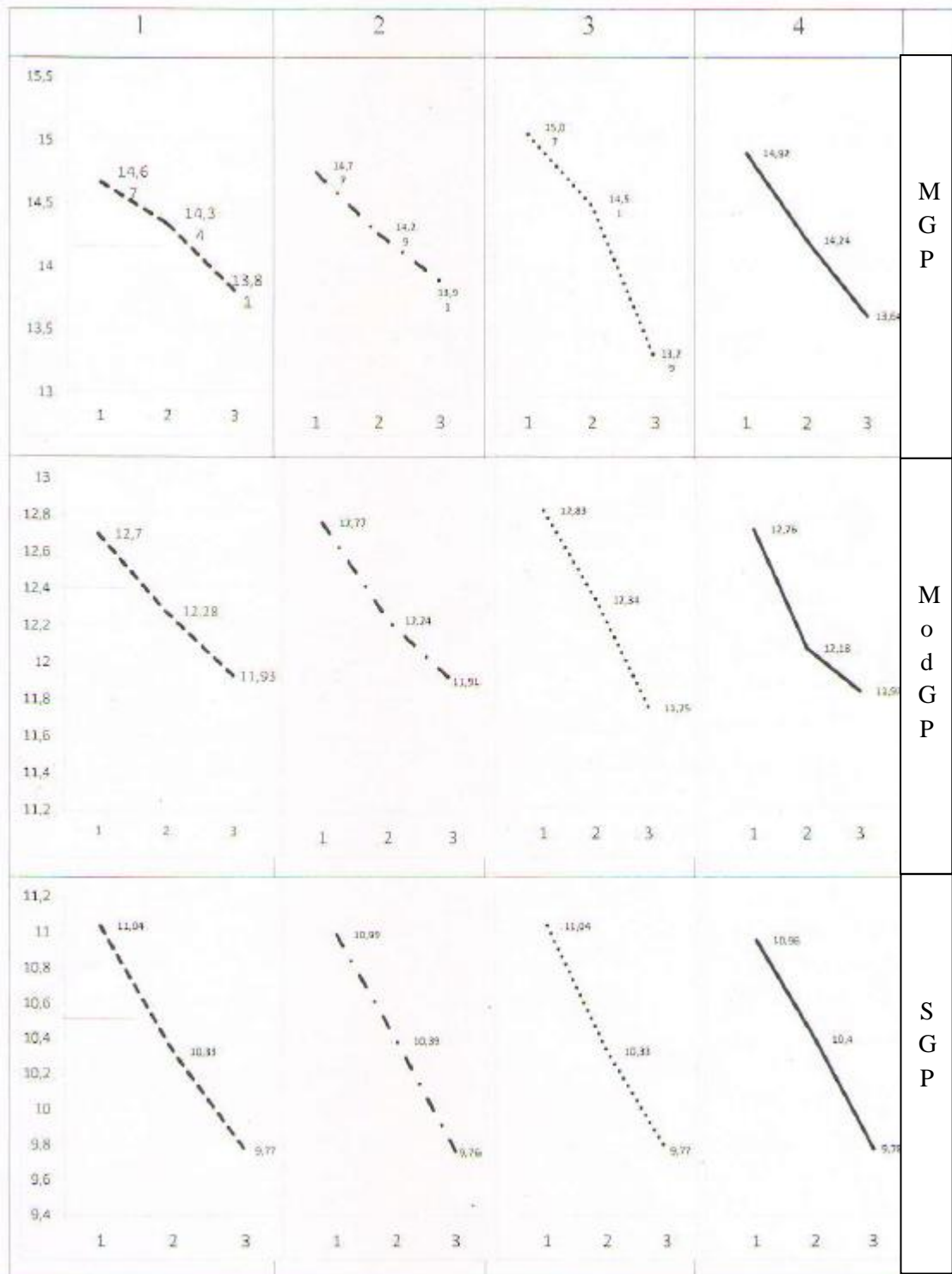


Figure. Mean values of microcirculation index (y) according to the intensity of factors impact – 1-trombothytes; 2-fibrinogen; 3-erythrocytes; 4-MD; PM mean value in the group

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