

Clinical and laboratory assessment of the state of periapical tissues in systemic lupus erythematosus

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ABSTRACT

Aim: To evaluate changes in clinical and laboratory parameters in patients with SLE depending on the severity and activity of the disease.

Materials and Methods: The study included 50 patients with SLE of different age groups, 10 men and 40 women.

Results: Systemic lupus erythematosus (SLE) is a chronic disease that belongs to the group of rheumatic diseases and is characterised by autoimmune tissue damage. Chronic inflammatory periodontal diseases remain one of the most common dental pathologies. Chronic gingivitis and periodontitis in SLE are described as one of the earliest and most striking symptoms of the disease. Approximately the same trend was found in patients with SLE depending on the degree of clinical and laboratory activity of the disease. Patients with minimal, 1 degree of activity (characterized by the longest duration of SLE) showed the greatest decrease in bone mineral density (up to 2.25 points), and patients with higher activity had a significantly shorter duration of SLE and, accordingly, a smaller decrease in bone mineral density: in patients with 2 degrees of activity (1.79 points), with 3 degrees of activity (1.94 points).

Conclusions: In patients with acute SLE, the maximum value of the Muhlemann-Cowell index was 2.31 points, in patients with subacute SLE – 1.89 points, and in patients with chronic SLE – 1.58 points. CPITN values increase inversely with the nature of the course of SLE, which is associated with the duration of the underlying disease.

KEY WORDS: systemic lupus erythematosus, periodontitis, gingivitis, vasculitis

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INTRODUCTION

Chronic inflammatory periodontal diseases remain one of the most common dental pathologies, the effectiveness of treatment of which is still low [1, 2]. Despite the generally recognized role of microbial factors and occlusal disorders in their development, somatic disorders are one of the important aggravating factors of periodontal disease [3]. Especially relevant is the problem of diagnosing dentogenic pathology among patients with chronic somatic diseases of autoimmune genesis, whose adequate immune responses change dramatically [4, 5].

Systemic lupus erythematosus is a chronic disease that belongs to the group of rheumatic diseases and is characterized by autoimmune tissue damage, mainly connective tissue and blood vessels, with the development of necrosis, hemorrhage, and thrombosis of various soft tissue areas, including the oral cavity [6].

Chronic gingivitis and periodontitis in SLE are described as one of the earliest and most prominent symptoms of the disease, but the literature remains

controversial regarding the features of periodontal pathology in SLE: some authors [7] speak of the long-term integrity of the periodontal tissues and the development of a process similar to periodontal disease, while others [8] describe early necrotic changes in the periodontium and associated tooth loss in patients with SLE. In SLE, severe immune, rheological, and degenerative disorders in tissues develop early enough, which negatively affects the periodontal condition [9].

In this regard, a number of issues related to the detailed characterization of periodontal pathology in SLE, their relationship with general immune homeostasis in the systemic lupus process, as well as the impact of SLE on the condition of the periradicular tissues of the oral cavity have not been sufficiently reflected in studies [10].

AIM

To evaluate changes in clinical and laboratory parameters in patients with SLE depending on the severity and activity of the disease.

MATERIALS AND METHODS

The study included 50 patients with SLE (10 men, 40 women) of different age groups from 20 to 55 years (mean age was 38.8 ± 7.6 years). All patients were treated in the rheumatology department of the named A. Novak ZRCH.

The comparison group consisted of 30 patients who sought treatment for periodontal diseases and had no somatic pathology (11 men, 19 women, mean age 37.1 ± 7.3 years). The age and sex distribution of the control group corresponded to that of patients with SLE. All selected patients met the diagnostic criteria for SLE.

According to the nature of the underlying disease, patients with SLE were distributed as follows: acute course – 9 (18%) patients, subacute – 10 (20%), chronic course – 31 (62%). By the degree of SLE activity: I degree – 16 (32%), II degree – 19 (38%), III degree – 15 (30%) patients.

All patients underwent a comprehensive clinical and laboratory examination using general and special methods. General methods, including clinical examination of organs and systems, radiography of the TMJ and hand joints to determine the radiological stage of the disease, laboratory tests to determine the degree of activity of the process.

To determine the degree of general inflammatory activity of the disease, all patients underwent determination of hemoglobin, leukocytes, immunoglobulins, ESR in peripheral blood, biochemical and immunological parameters.

Immunological studies of blood serum were performed to determine the titer of rheumatoid factor from the latex test, cryoprecipitins, complement, antibodies to nucleoprotein, anti-DNA, antinuclear factor, and antistreptolysin.

Standard dental examinations were carried out according to the generally accepted methodology. Complaints, medical history, general status, and dental examination data were recorded. During the external examination, attention was paid to the condition of the skin (presence of hyperemia, edema), facial configuration and expression. Particular attention was paid to the symmetry of the face in the position of central occlusion. In the presence of areas of swelling or deformation in the study area, their location and skin color were determined. The examination of the oral cavity began with an examination of the mucous membrane.

Attention was paid to the presence of edema, hyperemia, infiltration, erosion, ulcers, scars. The examination of the dentition took into account the location of defects in the teeth or crowns, the presence of extracted teeth, periodontal preservation, tooth mobility, bite condition, occlusal dysfunction, and other deformities

of the hard and soft tissues of the face. When examining the periodontium, attention was paid to the color, shape, consistency of the gingival papillae and marginal gingival margin, the presence of exudation, hypertrophy, ulcers, the degree of tooth mobility, exposure of the necks and roots of the teeth, and the presence of gingival pockets. The location and nature of dental plaque was determined.

Special research methods included a set of objective indicators characterizing the condition of teeth and periodontal tissues (for the convenience of mathematical processing of the results, numerical expressions using indices were used). The intensity of dental caries in the examined patients was assessed using the CPV index, the condition of the periodontal tissues – using the Green-Vermillion hygiene index, the CPITN index of the need for periodontal disease treatment, the Russel periodontal index, the Silness-Loe gingivitis index, and the Muhlemann-Cowell bleeding index.

The reliability of the results was evaluated according to the Student's t-test as follows: the arithmetic mean – M , standard deviation and standard error of the arithmetic mean – m , Student's coefficient were calculated. The value of $p < 0.05$ was taken as a significant difference.

The databases collected by us, containing information on the characteristics of patients and research results, were subjected to statistical processing using Jamovi 2.2.5 program.

The statistical processing determined the compliance of the studied indicators with the normal distribution. The arithmetic mean, standard deviation, standard error, skewness, Pearson and Spearman correlation coefficients were calculated.

Absolute and relative differences in a number of dynamic indicators were calculated, as well as the above parameters for absolute and relative differences.

Statistical hypotheses when comparing samples under conditions of normal distribution were tested using the Student's t-test, paired Student's test, and in other cases, the Fisher's exact test, Kolmogorov-Smirnov test, and other non-parametric criteria.

Correlation and regression analyses were conducted using a number of specialized packages for processing statistical information on ordinal, rank and nominal scales. The correlation coefficients exceeding the absolute value of 0.30 were considered statistically significant.

RESULTS

SLE is a chronic, often lifelong disease with a polymorbid component and numerous clinical symptoms, a number of which have a significant impact on the peri-



Fig. 1. Pathological elements on the skin of the face in SLE (rosaceous symmetrical hyperemic spots).

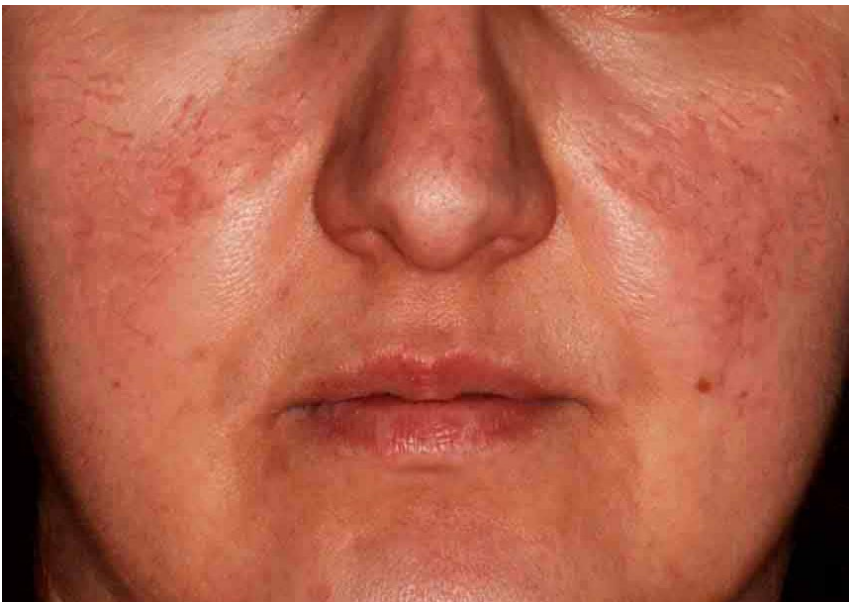


Fig. 2. Symmetrical skin lesions in SLE (telangiectasias, hyperemic spots, rosacea).

odontium. The average age of the examined patients did not reveal any differences depending on the nature of the course and the degree of clinical and laboratory activity of SLE; most patients were aged 28-45 years. The mean age of patients with acute course of SLE was 41.2 ± 10.3 years, with subacute course – 34.4 ± 10.2 years, with chronic course – 39.5 ± 9.6 years.

SLE has a vivid clinical picture involving the maxillofacial area, where the symptoms are clearly visible, quite evident and can be verified by doctors. The skin of the face with SLE usually shows foci of dermatitis in the characteristic “butterfly” shape – these are hyperemic spots or pronounced telangiectasias with elements of vasculitis (Fig. 1, Fig. 2).

In the mouth, vasculitis is manifested by various pathological elements: spots, papules, and sometimes

ulcers (Fig. 3). Thus, there is often a focus of congestive hyperaemia along the midline of the hard palate (enanthema), which is sometimes accompanied by erosion and ulceration.

Periodontal lesions in SLE (Fig. 4, Fig. 5) in the initial stages of the disease are represented by catarrhal gingivitis, which is characterized by acute (and then chronic) inflammation. As a rule, the marginal gingiva of one or both dentitions is affected. Clinically, the pathological process in the initial stage often manifests itself in the form of bright hyperemia and swelling of the gingival margin, somewhat reminiscent of hypertrophic gingivitis (edematous form).

Patients complained of pain, discomfort, sometimes burning sensation in the gums, bad breath, bleeding gums when eating or brushing teeth. In the case of



Fig. 3. Symmetrical spots in SLE on the palatal mucosa.

chronic SLE lasting at least 5 years, the bright hyperemia of the marginal gingival margin and interdental papillae was replaced by a stagnant cyanotic tint, and was thickened (as in roller-like thickening). Later, the process progressed as periodontitis with the formation of periodontal pockets, destruction of the tooth-gingival attachment and increased tooth mobility. In severe cases, tooth displacement in the dentition and occlusion disorders were observed.

In patients with SLE, the clinical picture of periodontitis was often aggravated by multiple manifestations of vasculitis, telangiectasia, and petechiae. In the area of these elements, patients had a particularly severe course of periodontitis. As a rule, the presence of large subcutaneous and submucosal hemorrhages, petechiae, ecchymoses in patients with SLE was combined with the presence of antiphospholipid syndrome, which often aggravates the course of SLE and is characterized by significant hemodynamic disorders. Large areas of hemorrhage and vasculitis sometimes involve large areas of the body.

The aggravating factors also include frequent trophic disorders in the distal parts of the body (especially the hands and feet). When located in the area of the hands, this significantly impaired the function of the hands, which affected the level of oral hygiene and, of course, worsened the level of oral hygiene, the

accumulation of dental plaque and complicated the course of periodontal pathology.

In patients without adequate therapy, periodontal destructive phenomena rapidly increased, which were complemented by necrotic elements of vasculitis, multiple petechiae, and ulcers. With the progression of the underlying disease, the destruction of the gingival ligament and increased tooth mobility occurred. The clinical picture of inflammatory and dystrophic changes was combined with destructive changes in the bone tissues surrounding the tooth, characterized by the presence of deep bone "pockets" in the long course of the disease and causing tooth loss. This is consistent with the data of a group of authors [11, 12] who described early tooth loss in SLE.

When discussing clinically significant factors of SLE that affect the severity of periodontal pathology, we note, first of all, mineral metabolism disorders: a decrease in bone mineral density in patients with SLE was inversely proportional to the activity of the underlying disease. Thus, in patients with acute SLE, the mean value of bone mineral density reduction was 1.76 points; it was approximately the same in the subgroup of patients with subacute SLE (1.66 points), and in patients with chronic SLE, a significantly greater reduction in bone mineral density was found (up to 2.17 points); the data obtained are likely to be explained



Fig. 4. Catarrhal gingivitis in SLE.



Fig. 5. Catarrhal gingivitis in SLE, marginal gingival involvement.

by the longer duration of SLE, during which a greater decrease in bone mineral density occurs. Patients with a chronic course are still distinguished by a prolonged course of the underlying disease.

The analysis of the results of the oral cavity assessment in patients with SLE is presented in Table 1.

Approximately the same trend was found in patients with SLE depending on the degree of clinical and laboratory activity of the disease. Patients with minimal, 1 degree of activity (characterized by the longest duration of SLE) showed the greatest decrease in bone mineral density (up to 2.25 points), and patients with higher activity had a significantly shorter duration of SLE and, accordingly, a smaller decrease in bone mineral density: in patients with 2 degrees of activity (1.79 points), with 3 degrees of activity (1.94 points).

We analyzed the features of periodontal status in the examined patients with SLE. It was found that the values of the CPITN index increased in inverse proportion to the nature of the course of SLE, which

is also probably associated with the duration of the underlying disease: in patients with acute SLE, the average value of the CPITN index was 1.69 oral sextants, with subacute course – 1.82 sextants, with chronic course – 2.56 sextants. The same trend was noted in the analysis depending on the degree of clinical and laboratory activity: in patients with grade 1, which is usually characterized by the longest course, the average value of the CPITN index was 2.57 sextants, with grade 2 activity – 2.37 sextants, with grade 3 – 1.91 sextants.

The Russel index values did not show a pronounced dependence on the nature of the course of SLE or the degree of clinical and laboratory activity, amounting to: in acute SLE – 3.17 points, in subacute course – 2.72 points, in chronic course – 3.24 points; in grade 1 clinical and laboratory activity of SLE – 2.87 points, in grade 2 – 3.42 points, in grade 3 – 3.02 points.

We also did not find significant differences in the analysis of Lo-Silence index values depending on the

Table 1. Index assessment of the hygienic and clinical condition of periodontal tissues in patients with SLE depending on clinical and laboratory characteristics of the underlying disease

Characteristics of the SPS	Medium age, years	Degree osteopenia interalveolar partitions, points	Average CPITN index, sextants	Average Russel index, points	Average Green-. Vermillion index, points	Average Loe-Silence index, points	Average Muhlemann-. Cowell bleeding index, points
Nature of the course of SLE							
- acute (n=10)	41.2±10.3	1.76±0.05	1.69±0.06	3.17±0.05	1.55±0.01	2.01±0.05	2.31±0.05
- subacute (n=9)	34.4±10.2	1.66±0.064 *p=0.0014	1.82±0.054 * p=0.0001	2.72±0.08 * p=0.0001	1.47±0.023 * p=0.0001	1.55±0.07 * p=0.0001	1.89±0.018 * p=0.0001
- chronic (n=31)	39.5±9.6	2.17±0.012 **/*** p=0.0001	2.56±0.015 **/*** p=0.0001	3.24±0.07 ** p=0.005 ***p=0.0001	1.79±0.014 **/*** p=0.0001	1.65±0.034 **/*** p=0.0001	1.58±0.015 **/*** p=0.0001
The degree of clinical and laboratory activity of SLE							
1 (n=16)	37.2±8.9	2.25±0.013	2.57±0.01	2.87±0.05	1.61±0.010	1.68±0.01	1.69±0.015
2 (n=19)	40.4±9.2	1.79±0.02 * p=0.0001	2.37±0.03 * p=0.0001	3.42±0.06 * p=0.0001	1.85±0.018 * p=0.0001	1.72±0.015 * p=0.0001	1.61±0.03 * p=0.0001
3 (n=15)	38.4±9.5	1.94±0.021 **/*** p=0.0001	1.91±0.018 **/*** p=0.0001	3.02±0.08 **/*** p=0.0001	1.54±0.015 **/*** p=0.0001	1.68±0.012 *** p=0.0001	2.07±0.02 **/*** p=0.0001

* - statistical significance between acute and subacute or grade 1 and 2 of ACS; ** - statistical significance between acute and chronic or grade 1 and 3 of ACS; *** - statistical significance between subacute and chronic or grade 2 and 3 of ACS.

nature of the course and the degree of activity of the underlying disease: in patients with acute SLE, the mean Lo-Silness index value was 2.01 points, in patients with subacute and chronic course – significantly less (1.55 and 1.65 points), and when comparing the degree of clinical and laboratory activity, we found practically no significant differences: In the subgroup with grade 1 activity, the mean value of the Loe-Silness index was 1.68 points, with grade 2 – 1.72 points, with grade 3 – 1.68 points.

DISCUSSION

It is characteristic that the influence of the activity of the underlying disease on the level of oral hygiene in patients with SLE has not been established: For example, in patients with acute course of SLE, the average value of the hygiene index was 1.55 points, with subacute course – 1.47 points, with chronic course – 1.79 points; with 1 degree of clinical and laboratory activity – 1.61 points, with 2 degree of activity – 1.85 points, with 3 degree of activity – 1.54 points. Similar data also have reported in overview of Z Rutter-Locher et al. [7].

A directly proportional relationship between the activity and nature of the course of SLE and the values of the Muhlemann-Cowell bleeding index was estab-

lished. Thus, in patients with acute SLE, the maximum value of the Muhlemann-Cowell bleeding index was 2.31 points, with subacute course – 1.89 points, with chronic course – 1.58 points. Such trends noted before M. Martínez-García et al. [3]. The same correlation was noted too with the degree of clinical and laboratory activity of SLE: in patients with minimal, 1 degree of activity, the mean value of the Muhlemann-Cowell bleeding index was 1.69 points, with 2 degree of activity – 1.61 points, with 3 degree of activity – the maximum value (2.07 points).

Thus, the data obtained show that the severity of periodontal damage in SLE depends more on the duration of the underlying disease than on its activity: It is the long-term course of SLE that has a more unfavorable effect on the periodontium, not its activity (probably due to the fact that the collagen structures of the periodontium are destroyed by a long-term pathological process, but the activity of the pathological process is much less important – the periodontium is quite resistant to many pathological processes, but it cannot withstand the long-term factor). In addition, an interesting fact was noted B. Sojod et al., (2021) about the direct correlation between the values of the Muhlemann-Cowell bleeding index and the degree of SLE activity – the latter indicates the

prevalence of vasculitis in the picture of periodontal pathology in SLE [8]. The severity of vasculitis, respectively, directly depends on the characteristics of the underlying disease (the nature of the course, the degree of clinical and laboratory activity, a number of laboratory parameters).

CONCLUSIONS

1. In patients with acute SLE, the maximum value of the Muhlemann-Cowell index was 2.31 points, in patients with subacute SLE – 1.89 points, and in patients with chronic SLE – 1.58 points.
2. The influence of the activity of the underlying disease on the level of oral hygiene in patients with SLE was not established: thus, in patients with acute SLE, the average value of the hygiene index was 1.55 points, with subacute course – 1.47 points, with chronic course – 1.79 points; with 1 degree of clinical and laboratory activity – 1.61 points, with 2 degree of activity – 1.85 points, with 3 degree of activity – 1.54 points.
3. CPITN values increase inversely with the nature of the course of SLE, which is associated with the duration of the underlying disease.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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