UDC 616.5-002-0709
DOI 10.59598/ME-2305-6053-2026-119-2-115-124

T. B. Ibrayeva[1*], Z. Jetpisbayeva[1], A. T. Nurmukhambetova[1], N. Z. Ramazanova[1], B. Yerbolatkyzy[1]

# COMPARATIVE MORPHO-FUNCTIONAL ASSESSMENT OF SKIN IN ECZEMA AND XEROSIS: THE ROLE OF NON-INVASIVE DERMATOSCOPY AND BIOENGINEERING METHODS

[1]Department of dermatovenerology and dermatocosmetology, NC JSC «Astana Medical University» (100000, Republic of Kazakhstan, Astana c., Beibitshilik str., 49a; e-mail: mail@amu.kz)

***Torgyn Berikzhanovna Ibrayeva** – Department of dermatovenerology and dermatocosmetology, NC JSC «Astana Medical University»; 100000, Republic of Kazakhstan, Astana c., Beibitshilik str., 49a; e-mail: ibraeva.t@amu.kz

*Introduction*. Dermatoscopy and bioengineering methods are high-value non-invasive diagnostic tools used to differentiate between eczema and xerosis, which often present with similar clinical features. Although both pathologies are characterized by skin dryness, their morphological and functional natures differ significantly.

*Aim*. To comparatively characterize the dermatoscopic signs and biophysical indicators of eczema and xerosis, to study the morphofunctional features of eczema and skin xerosis and to identify objective criteria for the differential diagnosis of these pathologies based on dermatoscopic signs and biophysical indicators (corneometry, sebometry, pH-metry).

*Materials and methods*. The study involved 32 patients with eczema and 27 patients with xerosis. The comprehensive diagnostic approach was employed: morphological changes were examined using polarized dermatoscopy, while the functional state of the skin was assessed through pH-metry, corneometry (moisture measurement) and sebometry (lipid level evaluation).

*Results and discussion*. In dermatoscopy, yellowish scales and an irregular arrangement of dotted vessels were characteristic for eczema, while thin white scales and an avascular background were the main markers for xerosis. Functional analysis revealed significantly lower skin hydration and lipid levels in the xerosis group, as well as changes in skin surface pH values. According to the Youden index, the avascular background, lipid deficiency, and pH-metric data had the highest value in clarifying the diagnosis of xerosis.

*Conclusion*. Combining dermoscopy with the results of pH-metry, corneometry, and sebumetry allowed for objective assessment of the «acid mantle» and the functional state of the skin, thereby enabling high-precision differentiation between eczema and xerosis.

*Key words:* dermatoscopy; eczema; xerosis; bioengineering; hydrogen ion concentration

## INTRODUCTION

Eczema is a common disease that manifests itself in the early stages, can become chronic over time, and causes many negative consequences [1]. The development of the disease manifested by disruption of the skin barrier, structural changes in the epidermis and dermis, and a decrease in the functional parameters of the skin. The weakening of the skin barrier function is associated with changes in the composition of its proteins and lipids, resulting in rapid loss of moisture and dryness of the skin [2, 3]. Thus, in eczema, the skin barrier is disrupted and inflammatory reactions are intensified, which creates conditions for the development of acute and chronic changes.

This pathology is characterized by three main morphological features; the presence of numerous small foci, a variety of clinical manifestations, and pronounced itching. In order to describe clinical polymorphism, the concept of the “eczema triangle” used in German and Japanese dermatology. Multifocal lesions manifested by the appearance of individual papules and vesicles in different areas of the skin. In acute eczema, erythema, papules, seropapules, vesicles, pustules, scaling, and crusting observed. In chronic eczema, skin thickening, increased pigmentation, or in some cases, its decrease, are characteristic [4, 5]. These changes lead to the clinical manifestation of skin lesions and the formation of foci of lichenification. Apart from these common symptoms, itching, burning and pain considered to be among the most unpleasant symptoms for patients [6, 7].

Xeroderma or dry skin (xerosis cutis, asteatosis) is a common pathological condition that develops due to an imbalance in the hydrolipid balance of the skin. It manifests itself in the form of tightening, roughness, peeling and desquamation of the skin. As

a result, of increased itching, excoriations appear, increasing susceptibility to infectious complications [8, 9, 10]. An important role in the development of xerosis is the violation of the acid-base balance of the skin. Under normal conditions, the «acid mantle» of the skin inhibits the growth of bacteria and regulates the work of enzymes. In xerosis, the shift of the pH level towards an alkaline environment inhibits the enzymes responsible for the self-repair of the skin. This process disrupts the natural shedding of horny scales (desquamation), causing the accumulation of thick, rough scales on the surface of the skin.

Xerosis of the skin can caused by external factors, in particular, low temperatures and frequent skin cleansing. In addition, its development influenced by internal factors – age, hormonal changes and genetic predisposition. In some cases, xerosis manifests itself as a symptom of a number of systemic or dermatological diseases [10, 11, 12, 13].

These two conditions, based on a violation of the skin barrier function (eczema and xerosis) often confuse doctors in their practical work. This is because, although their external symptoms are similar, the treatment tactics are fundamentally different. Therefore, to clarify the diagnosis, visual examination alone is not enough, it is necessary to resort to the help of modern technical means.

Dermatoscopy is a non-invasive clinical tool for in vivo assessment of various structures in the epidermis and subepidermal layer of the skin. Conventional hand-held dermatoscopes provide 10x magnification, while videodermatoscopic systems provide significantly higher magnifications, up to 140x [14,15]. This method allows to clearly see the skin structures and detect pathological changes early. Dermatoscopy provides important information in clinical research and diagnosis. In addition, this method also used to monitor the effectiveness of treatment.

Sebumeter is a device for determining the amount of sebum on the skin. It allows not only for traditional measurements, but also for quantitative measurement (in μg/cm²) of oily residues on the skin from topical products [16]. The accuracy of the device allows monitoring the level of oil in the skin over time and evaluate the effect of various cosmetic or medical preparations. Its results provide reliable information in clinical studies and help determine individual skin care strategies. In addition, this method used as a standard method in the study of skin oil balance.

The outer layer of the skin (the epidermis) is the main barrier that maintains the moisture balance in the body and regulates the level of transepidermal water loss (TEWL). The secretions secreted by the sebaceous glands form a special lipid layer on the skin surface, which acts as a natural protective barrier that prevents excessive water evaporation. In pathologies such as eczema, the integrity of this barrier disrupted, causing dryness and persistent itching of the skin; such conditions can be corrected with topical therapy or special moisturizing methods. Currently, optical and electrical sensing technologies are widely used to accurately assess skin moisture [17, 18, 19, 20, 21].

Each method has its own unique characteristics: optical methods allow for a precise and visual assessment of the skin's surface structure, while electrical sensing quantitatively determines the amount of water in the skin. These two methods complement each other and allow for a comprehensive analysis of skin moisture levels. Skin moisture assessment often relies on the electrical properties of the stratum corneum.

A common tool for measuring this parameter is a corneometer, which records changes in the dielectric conductivity of a material when it is in contact with the skin [22]. Corneometer results help monitor skin condition, record moisture changes, and evaluate the effectiveness of skin care products. In addition, this tool is a standard and reliable method for studying skin physiology.

Measuring the pH level of the skin's surface layer allows clinical studies to monitor dangerous pH changes following external factors and to assess acute or chronic changes in damaged skin [23]. pH fluctuations can affect the structure of epidermal lipids, the balance of the microbiome, and enzymatic processes, leading to the development of inflammatory reactions or exacerbation of skin diseases. In this regard, measuring the pH of the skin surface is an important diagnostic method in dermatological practice and in assessing the effectiveness of treatment.

The device for measuring skin acidity based on the potentiometric principle. A sensitive glass electrode and a reference electrode combined in a special probe. When the device comes into contact with the skin, the glass electrode reacts with the activity of hydrogen ions and registers an electrical potential, which is compared with a constant voltage on the reference electrode. The resulting potential difference is displayed on the digital screen of the device as the actual pH value [24, 25].

Both conditions manifested by peeling and itching of the skin, which can lead to errors in clinical diagnosis. Since traditional biopsy is invasive, the use of modern methods such as dermatoscopy is relevant. Dermatoscopy allows studying the microstructure of the skin without invasive methods, demonstrating the relationship between clinical signs and histological changes. In addition, instrumental measurements such as corneometry, sebometry and pH-metry are used for a comprehensive assessment of the functional state of the skin.

**The aim of the study** was to comparatively characterize the dermatoscopic signs and biophysical indicators of eczema and xerosis, to study the morphofunctional features of eczema and skin xerosis and to identify objective criteria for the differential

**Table 1** – Distribution of dermatoscopic features between the eczema and xerosis groups

| Dermatoscopic parameter | | Group I | Group II | $\chi^2$ | p |
|---|---|---|---|---|---|
| Background color | Pink/Red | 28 (87.5%) | 7 (25.9%) | 22,94 | <.001 |
| | White/Pale | 4 (12.5%) | 20 (74.1%) | 22,94 | <.001 |
| Shell color | Yellow | 26 (81.3%) | 2 (7.4%) | 32,31 | <.001 |
| | White (dry) | 6 (18.7%) | 25 (92.6%) | 32,31 | <.001 |
| Root picture | Pointed roots | 27 (84.4%) | 3 (11.1%) | 31,54 | <.001 |
| Location | Irregular | 31 (96.9%) | 3 (11.1%) | 43,82 | <.001 |

diagnosis of these pathologies based on dermatoscopic signs and biophysical indicators (corneometry, sebometry, pH-metry).

## MATERIALS AND METHODS

The study included 59 patients aged 60-90 years with skin peeling and signs of inflammation. Patients were divided into two groups according to their clinical diagnosis: group I (eczema) – 32 individuals with chronic or acute eczema of the hands; group II (xerosis) – 27 individuals with pronounced dryness of the skin (xerosis cutis).

Inclusion and exclusion criteria were the following: patients over 60 years of age who had not received local or systemic hormonal therapy in the last 21 days were included in the study; individuals with infectious skin lesions and histologically questionable diagnosis were excluded from the study.

The study was conducted using DermLite DL4 (3Gen, USA) digital dermatoscope in polarized light mode. The affected areas of each patient were photographed at 20x and 50x magnification. During the evaluation, primary attention was focused on the background color, the morphology of the scales, and the distribution architectonics of the vascular pattern.

For the objective assessment of the functional indicators of the skin, diagnostic systems by Courage+Khazaka electronic GmbH (Germany) were used. The level of hydration of the stratum corneum (corneometry), the lipid layer and fat content of the skin surface (sebometry), as well as the assessment of the acid-base balance of the skin (pH metry) were carried out. The methods allowed to determine the state of the protective layer of the epidermis. The study was conducted on the skin of the forearms and hands of the patients and on the outer surface of the ankles and feet. All measurements were recorded under standard temperature and humidity conditions to avoid the influence of external factors.

The data obtained during the study processed in the IBM SPSS Statistics 22.0 software package. All quantitative results presented as the mean value and standard error (M+m). In order to compare qualitative indicators, such as the frequency of dermatoscopic signs, the Chi-square ($\chi^2$) criterion used. The difference in biophysical values (corneometry, sebometry and pH-metry) between the two groups was assessed using the Student's t criterion. To determine the effectiveness of diagnostic methods and the accuracy of markers, including acidity-alkali indicators, the Youden index (J) was calculated according to the formula:

$$J = \text{Sensitivity} + \text{Specificity} - 1 \quad (1)$$

The results considered reliable when the statistical significance level was $p<0.01$.

## RESULTS

Statistically significant differences recorded in the distribution of dermatoscopic features between the eczema and xerosis groups (table 1).

The study showed that the highest sensitivity and specificity in diagnosing eczema found to be irregularly arranged punctate veins. For xerosis, the combination of a vascular background and white scales had the highest diagnostic value (Table 2).

To illustrate these morphological differences, clinical and dermatoscopic images obtained during the study are presented below. The study subjects exhibited multifocal lesions characterized by dryness and signs of inflammation (fig. 1). Multifocal lesions on the lower legs of a patient from the study group. The skin exhibits signs of inflammation, dryness, and excoriations (scratch marks) resulting from itching.

Dermatoscopy revealed distinct morphological features for each condition. In patients with eczema, the most prominent signs were a deep red or pink background (87.5%) and yellowish scales (81.3%). The figure 2 demonstrates a characteristic pink/red background, indicating chronic inflammatory infiltration and vasodilation in the dermis. Yellowish scales are visible, corresponding to microexudation (serous exudate) absorbed into the hyperkeratotic layers. An irregular vascular pattern is also characteristic of this pathology.

In contrast, xerosis was characterized by a pale or whitish background (74.1%) and the presence of white dry scales (92.6%). The figure 3 shows a pale or whitish background with white dry scales, indicating a disruption in the desquamation process due to lipid deficiency. The significant absence of a vascular pattern (rootless background) confirms the non-inflammatory, degenerative nature of the condition.

**Table 2** – Diagnostic efficacy analysis

| Dermatoscopic marker | Sensitivity (%) | Specificity (%) | Youden index |
|---|---|---|---|
| Irregular vascular pattern (eczema) | 96,88 | 88,89 | 0,8577 |
| Rootless background (xerosis) | 85,19 | 96,88 | 0,8207 |
| Yellowish scales (eczema) | 81,25 | 92,59 | 0,7384 |

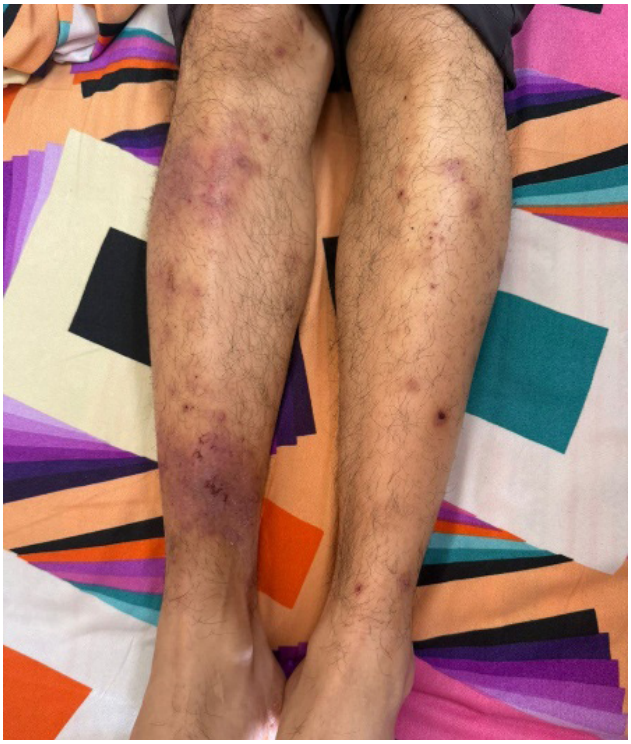

**Figure 1** – Multifocal lesions characterized by dryness and signs of inflammation

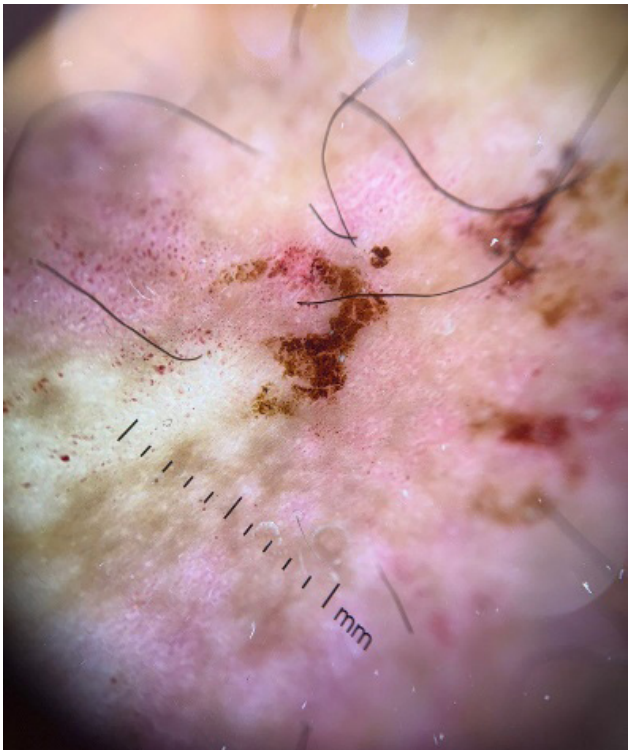


**Figure 2** - Dermatoscopy of chronic eczema

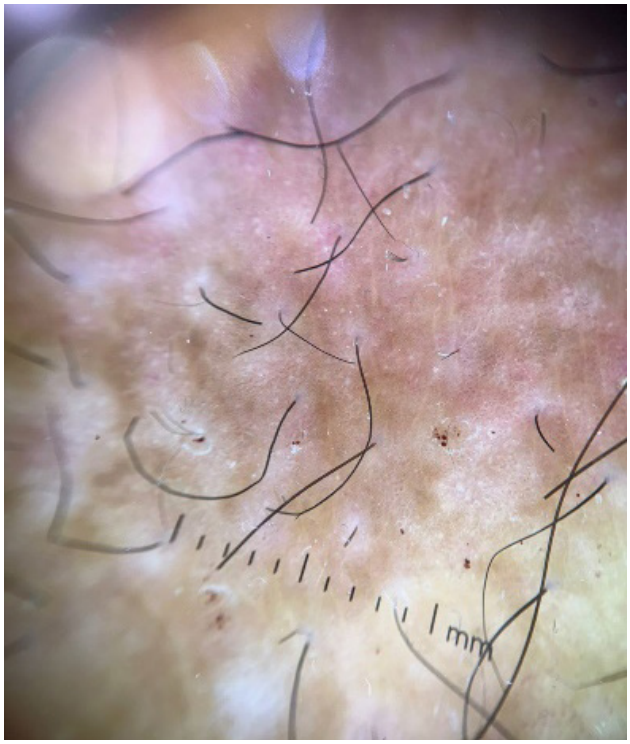


**Figure 3** – Dermatooscopy of xerosis

The diagram presents comparative data on the biophysical condition of the skin in patients. It displays the mean values of three key indicators: skin pH, sebumetry (lipid/sebum levels), and corneometry (hydration levels), measured on two body sites—the forearms/hands and lower legs. The data reveal critically low lipid levels (approx. 14-17 μg/cm²) and hydration (30-31 units), as well as a pH shift towards alkalinity (above 5.5), confirming the disruption of the skin barrier in eczema and xerosis (fig. 4).

## DISCUSSION

The results of the study show that although eczema and xerosis appear clinically similar, their functional and morphological features are completely different. The integrated diagnostic method we used - combining visual dermatoscopy with biophysical measurements - allows us to reduce errors in diagnosis. Although eczema and xerosis appear clinically similar, their functional and morphological features are completely different. The integrated diagnostic method we used - combining visual dermatoscopy with biophysical measurements - allows us to reduce errors in diagnosis. The most pronounced dermatoscopic signs of chronic eczema are brown-pink dots, yellow scales and yellow-pink scales. In addition, less

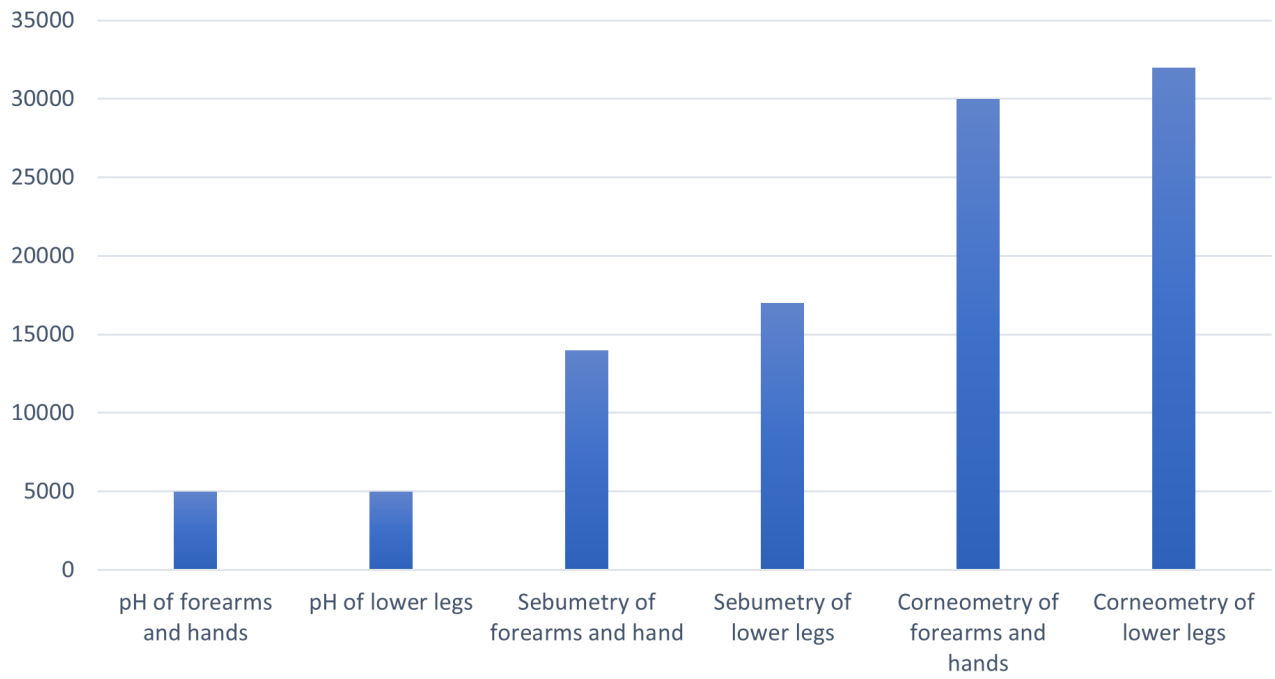


**Figure 4** – Comprehensive assessment of biophysical skin parameters in the studied patients

common signs include local pale peeling and the appearance of pinpoint veins, which allow us to assess the degree of skin damage and morphological features of the disease [26, 27, 28].

These visual markers closely related to a decrease in skin moisture levels (corneometry). Thus, dermatoscopic examination is an objective method that allows assessing not only changes on the skin surface, but also microcirculatory and metabolic disorders in its deeper layers. Primary acute clinical lesions include erythema, edema, papules and vesicles, rarely bullae. Secondary chronic lesions include crusts, lichenification, hyperkeratosis, scaling and fissures [29, 30].

Chronic eczema in elderly patients characterized by the absence of spongiosis characteristic of the acute inflammatory phase. In chronic eczema, new papular or vesicular elements gradually disappear, and in their place, changes such as hyperkeratosis, thickening of the epidermis (acanthosis), and dermal fibrosis lead to the development of lichenification, which characterized by thickening of the skin and flaking. As a result, of constant and intensive scratching of the affected areas, large, pronounced lichenified nodules may appear.

Another characteristic feature of the chronic process is hyperpigmentation, which in atopic dermatitis often manifests itself in the form of a “dirty neck”. In some cases, depigmentation is observed along with chronic lesions, which is considered to be leukoderma or vitiligo-like changes and occurs in approximately a certain proportion of patients with atopic dermatitis [4, 31].

In the study, 87.5% of patients with eczema had the deep red or pink background. This is a clear sign of chronic inflammatory infiltration and vasodilation in the dermis. The most important diagnostic marker is the irregular arrangement of punctate vessels (96.9%). The presence of  Youden index of 0.8577 confirms the high reliability of this sign in differentiating eczema from xerosis.

The predominance of yellowish scales in eczema foci (81.3%) indicates that, despite the clinical reduction of spongiosis, microexudation (serous exudate) is still present in the deep layers of the skin. This exudate is absorbed into the hyperkeratosis layers and is visible on dermatoscopy as a «yellow drop» or yellowish scales. The specificity of this sign was 92.59%. Xerosis is not an inflammatory condition, but a result of depletion of the structural and functional resources of the skin. Our study clearly demonstrated the unique «rootless» nature of xerosis.

Dermatoscopic examination of the skin of elderly individuals revealed a widespread presence of uneven pigmentation and vascular telangiectasia (linear and branching veins) [32].

The main features of xerosis were a pale or whitish background (74.1%) and a complete absence or very rare occurrence of vascular patterns (only 11.1%). The specificity of the «vessel-less background» marker was 96.88%, confirming that xerosis is a non-inflammatory degenerative process.

The characteristic white dry scales of xerosis (92.6%) indicate a violation of the desquamation (falling off) process of corneocytes in the stratum corneum of the skin. In this case, the scales appear «powdery» or plate-like due to the complete absence of moisture and lipids in the surface layer of the skin.

In practical dermatology, the following classification based on specific criteria used to clarify the de-

gree of skin dehydration: In mild cases, the process of desquamation observed only within the natural lines and folds of the skin. In moderate cases, desquamation extends to areas outside the skin folds, and changes in the skin contour become noticeable. In severe cases, large plate-like scales form on the skin surface, and the pathological process complicated by the appearance of deep cracks. Such a dermatoscopic grading system allows clinicians to track the dynamics of external and internal factors affecting the progression of xerosis, as well as to objectively assess the effectiveness of the prescribed therapeutic course [8, 32].

The hardware data obtained during the study revealed the pathophysiological causes of the dermatoscopic appearance.

Sebometric indicators clearly showed atrophy of the sebaceous glands in elderly patients: on the forearms – 14.105 μg/cm², on the ankles – 17.044 μg/cm². Such a critically low level of lipids indicates the destruction of the hydrolipid mantle of the skin. This is the main reason for the appearance of «white flakes» and a feeling of tightness of the skin in xerosis. Low oiliness makes the skin too sensitive to any external influences (temperature, clothing).

Corneometric values in the range of 30.6-31.0 units confirm pronounced dehydration of the skin. This is an indicator of high TEWL. In eczema, this indicator may be somewhat unstable compared to xerosis due to chronic inflammatory infiltration, but in general it indicates a violation of the barrier function of the skin.

Skin pH between 5.045 and 5.552 indicates a weakened skin «acid mantle» in elderly patients. A pH close to or above 5.5 (alkalinization) creates favorable conditions for bacterial growth on the skin and increased itching in chronic eczema.

In chronic eczema, itchy and painful skin is often experienced by patients, significantly negatively impacting their quality of daily life [33, 34, 35].

Thus, our study showed that dermatoscopic irregular punctate veins (Youden index 0.8577) and yellowish scales (specificity 92.59%) are the most important diagnostic criteria for differentiating chronic eczema from xerosis. In addition, instrumental diagnostics (sebometry, corneometry, pH-metry) objectively proved the hydrolipidic deficiency and acid-base imbalance underlying these pathologies. This comprehensive diagnostic approach allows for accurate diagnosis of skin diseases in elderly patients and the appointment of effective pathogenetic therapy.

## CONCLUSION

The results of the study showed that in patients aged 60-90 years, biophysical parameters of the skin decrease to a critical level. These data justify the need for the mandatory use of intensive emollient therapy aimed at restoring the barrier function of the skin, not limited to anti-inflammatory therapy, in the treatment of eczema and xerosis in the elderly persons.

The combination of visual dermatoscopic assessment with instrumental biophysical methods (corneometry, sebummetry, pH-metry) allows for a comprehensive assessment of not only external morphological changes in the skin, but also its deep functional state. The irregular vascular pattern and yellowish scales detected in chronic eczema indicate the exudative nature of the pathological process, while the vascular background and pale-dry scales characteristic of xerosis characterize a pronounced depletion of the lipid-structural reserves of the skin.

Although lichenization and acanthosis, which are common in old age, obscure the classic clinical signs, dermatoscopic markers have a high diagnostic value in differential diagnosis. In addition, the correlation between the decrease in skin moisture and oiliness and the shift of pH to an alkaline environment indicates a violation of the skin barrier and the creation of favorable conditions for the persistence of a chronic inflammatory process. Thus, the data obtained demonstrate the importance of considering morphological and functional changes in the skin as a single system. The proposed comprehensive diagnostic approach not only reduces diagnostic errors, but also allows the development of pathogenetically justified and clinically effective treatment strategies, taking into account the age characteristics and individual biophysical parameters of the patient.

***Author contributions:***

T. B. Ibraeva, Z. Jetpisbaeva – study concept and design.

A. T. Nurmukhambetova, B. Yerbolatkyzy – data collection and processing.

N. J. Ramazanova – statistical analysis.

T. B. Ibraeva, B. Yerbolatkyzy – writing the text.

Z. Jetpisbaeva – editing.

***Conflict of interest:***

The authors declare no conflicts of interest.

## REFERENCES

1. Schwensen J.F.B., Quaade A.S., Simonsen A.B., Dietz J.B., Zachariae C., Johansen J.D. Hand eczema. *Ugeskr. Laeger*. 2025; 187 (14): V10240682. https://doi.org/10.61409/V10240682

2. Tauber M., Bérard E., Lourari S., et al. Latent class analysis categorizes chronic hand eczema patients according to skin barrier impairment. *J. Eur. Acad. Dermatol. Venereol.* 2020; 34 (7): 1529-1535. https://doi.org/10.1111/jdv.16083

3. Sølberg J.B.K., Quaade A.S., Drici L., et al. The proteome of hand eczema assessed by tape stripping. *J. Invest. Dermatol.* 2023; 143 (8): 1559-1568. https://doi.org/10.1016/j.jid.2022.12.024

4. Tokura Y., Yunoki M., Kondo S., Otsuka M. What is «eczema»? *J. Dermatol.* 2025; 52 (2): 192-203. https://doi.org/10.1111/1346-8138.17439

5. Krasteva M., Kehren J., Sayag M., Duclu-zeau M.T., Dupuis M., Kanitakis J., Nicolas J.F. Contact dermatitis II. Clinical aspects and diagnosis. *Eur. J. Dermatol.* 1999; 9 (2): 144-159.

6. Apfelbacher C., Bewley A., Molin S., et al. Prevalence of chronic hand eczema in adults: a cross-sectional survey of over 60 000 respondents from the general population of Canada, France, Germany, Italy, Spain and the UK. *Br. J. Dermatol*. 2025; 192 (6): 1047-1054. https://doi.org/10.1093/bjd/ljaf020

7. Yüksel Y.T., Thyssen J.P., Nørreslet L.B., Flachs E.M., Ebbehøj N.E., Agner T. A comparison between self-reported hand eczema and self-reported signs and symptoms of skin lesions indicating hand eczema. *Contact Dermatitis*. 2022; 87 (6): 528-534. https://doi.org/10.1111/cod.14183

8. Gade A., Matin T., Rubenstein R. *Xeroderma.* https://www.ncbi.nlm.nih.gov/books/NBK565884/

9. Parker J., Scharfbillig R., Jones S. Moisturisers for the treatment of foot xerosis: a systematic review. *J. Foot Ankle Res.* 2017; 10: 9. https://doi.org/10.1186/s13047-017-0190-9

10. Augustin M., Wilsmann-Theis D., Körber A., Kerscher M., Itschert G., Dippel M., Staubach P. Diagnosis and treatment of xerosis cutis – a position paper. *J. Dtsch. Dermatol. Ges.* 2019; 17 (7): 3-33. https://doi.org/10.1111/ddg.13906

11. Vestergaard C., Torrelo A., Christen-Zaech S. Clinical Benefits of Basic Emollient Therapy for the Management of Patients With Xerosis Cutis. *Int. J. Dermatol.* 2025; 64 (1): 47-52. https://doi.org/10.1111/ijd.17792

12. Moncrieff G., Cork M., Lawton S., Kokiet S., Daly C., Clark C. Use of Emollients in Dry-Skin Conditions: Consensus Statement. *Clin. Exp. Dermatol.* 2013; 38 (3): 231-238. https://doi.org/10.1111/ced.12104

13. Pons-Guiraud A. Dry skin in dermatology: a complex physiopathology. *J. Eur. Acad. Dermatol. Venereol.* 2007; 21 (2): 1-4. https://doi.org/10.1111/j.1468-3083.2007.02379.x

14. Korecka K., Pogorzelska-Dyrbuś J., Polańska A., Dańczak-Pazdrowska A., Lallas A. Magnified Dermoscopy in Skin Cancer and Infectious Skin Diseases. *Medicina (Kaunas)*. 2025; 61 (11): 1970. https://doi.org/10.3390/medicina61111970

15. Campos-do-Carmo G., Ramos-e-Silva M. Dermoscopy: basic concepts. *Int. J. Dermatol.* 2008; 47 (7): 712-719. https://doi.org/10.1111/j.1365-4632.2008.03556.x

16. Crowther J.M. Method for quantification of oils and sebum levels on skin using the Sebumeter®. *Int. J. Cosmet. Sci.* 2016; 38 (2): 210-216. https://doi.org/10.1111/ics.12258

17. Gidado I.M., Nwokoye I.I., Triantis I.F., Qassem M., Kyriacou P.A. Multi-Modal Spectroscopic Assessment of Skin Hydration. *Sensors (Basel)*. 2024; 24 (5): 1419. https://doi.org/10.3390/s24051419

18. Boer M., Duchnik E., Maleszka R., Marchlewicz M. Structural and biophysical characteristics of human skin in maintaining proper epidermal barrier function. *Adv. Dermatol. Allergol.* 2016; 33 (1): 1-5. https://doi.org/10.5114/pdia.2015.48037

19. Bhattacharya N., Sato W.J., Kelly A., Ganguli-Indra G., Indra A.K. Epidermal Lipids: Key Mediators of Atopic Dermatitis Pathogenesis. *Trends. Mol. Med.* 2019; 25 (6): 551-562. https://doi.org/10.1016/j.molmed.2019.04.001

20. Martinsen Ø., Grimnes S. Long-Term Effect of Some Skin Moisturizers. *Open Dermatol. J.* 2008; 2: 87-89. https://doi.org/10.2174/1874372200802010087

21. Barnes T.M., Mijaljica D., Townley J.P., Spada F., Harrison I.P. Vehicles for Drug Delivery and Cosmetic Moisturizers: Review and Comparison. *Pharmaceutics*. 2021; 13 (12): 2012. https://doi.org/10.3390/pharmaceutics13122012

22. Lodén M., Hagforsen E., Lindberg M. The presence of body hair influences the measurement of skin hydration with the Corneometer. *Acta Derm. Venereol.* 1995; 75 (6): 449-450. https://doi.org/10.2340/0001555575449450

23. Ehlers C., Ivens U.I., Møller M.L., Senderovitz T., Serup J. Comparison of two pH meters used for skin surface pH measurement: the pH meter 'pH900' from Courage & Khazaka versus the pH meter '1140' from Mettler Toledo. *Skin Res. Technol.* 2001; 7 (2): 84-89. https://doi.org/10.1034/j.1600-0846.2001.70205.x

24. Prakash C., Bhargava P., Tiwari S., Majumdar B., Bhargava R.K. Skin Surface pH in Acne Vulgaris: Insights from an Observational Study and Review of the Literature. *J. Clin. Aesthet. Dermatol.* 2017; 10 (7): 33-39.

25. Luebberding S, Krueger N, Kerscher M. Skin physiology in men and women: in vivo evaluation of 300 people including TEWL, SC hydration, sebum content and skin surface pH. *Int. J. Cosmet. Sci.* 2013; 35 (5): 477-483. https://doi.org/10.1111/ics.12068

26. Errichetti E., Stinco G. Dermoscopy in General Dermatology: A Practical Overview. *Dermatol Ther (Heidelb)*. 2016; 6 (4): 471-507. https://doi.org/10.1007/s13555-016-0141-6

27. Errichetti E., Stinco G. Dermoscopy in differential diagnosis of palmar psoriasis and chronic hand eczema. *J. Dermatol.* 2016; 43 (4): 423-425. https://doi.org/10.1111/1346-8138.13142

28. Errichetti E., Stinco G. Dermoscopy as a supportive instrument in the differentiation of the main types of acquired keratoderma due to dermatological disorders. *J. Eur. Acad. Dermatol. Venereol.* 2016; 30 (6): e229-e231. https://doi.org/10.1111/jdv.13566

29. Weisshaar E. Chronic Hand Eczema. *Am. J. Clin. Dermatol.* 2024; 25 (6): 909-926. https://doi.org/10.1007/s40257-024-00890-z

30. Thyssen J.P., Schuttelaar M.L.A., Alfonso J.H., et al. Guidelines for diagnosis, prevention, and treatment of hand eczema. *Contact Dermatitis.* 2022; 86 (5): 357-378. https://doi.org/10.1111/cod.14035

31. Kuriyama S., Kasuya A., Fujiyama T., Tatsuno K., Sakabe J., Yamaguchi H., Ito T., Tokura Y. Leukoderma in patients with atopic dermatitis. *J. Dermatol.* 2015; 42 (2): 215-218. https://doi.org/10.1111/1346-8138.12746

32. Hu S.C., Lin C.L., Yu H.S. Dermoscopic assessment of xerosis severity, pigmentation pattern and vascular morphology in subjects with physiological aging and photoaging. *Eur. J. Dermatol.* 2019; 29 (3): 274-280. doi: https://doi.org/10.1684/ejd.2019.3555

33. Molin S., Guttman-Yassky E., Thyssen J.P., Bewley A. Chronic Hand Eczema, Real World, and Patient Centricity: A Narrative Review. *Acta Derm. Venereol.* 2025; 105: adv42596. https://doi.org/10.2340/actadv.v105.42596

34. Weidinger S., Novak N. Hand eczema. *Lancet*. 2024; 404 (10470): 2476-2486. https://doi.org/10.1016/S0140-6736(24)01810-5

35. Grant L., Seiding Larsen L., Burrows K., et al. Development of a Conceptual Model of Chronic Hand Eczema (CHE) Based on Qualitative Interviews with Patients and Expert Dermatologists. *Adv. Ther.* 2020; 37 (2): 692-706. https://doi.org/10.1007/s12325-019-01164-5

**TRANSLITERATION**

1. Schwensen J.F.B., Quaade A.S., Simonsen A.B., Dietz J.B., Zachariae C., Johansen J.D. Hand eczema. *Ugeskr. Laeger*. 2025; 187 (14): V10240682. https://doi.org/10.61409/V10240682

2. Tauber M., Bérard E., Lourari S., et al. Latent class analysis categorizes chronic hand eczema patients according to skin barrier impairment. *J. Eur. Acad. Dermatol. Venereol.* 2020; 34 (7): 1529-1535. https://doi.org/10.1111/jdv.16083

3. Sølberg J.B.K., Quaade A.S., Drici L., et al. The proteome of hand eczema assessed by tape stripping. *J. Invest. Dermatol.* 2023; 143 (8): 1559-1568. https://doi.org/10.1016/j.jid.2022.12.024

4. Tokura Y., Yunoki M., Kondo S., Otsuka M. What is «eczema»? *J. Dermatol.* 2025; 52 (2): 192-203. https://doi.org/10.1111/1346-8138.17439

5. Krasteva M., Kehren J., Sayag M., Ducluzeau M.T., Dupuis M., Kanitakis J., Nicolas J.F. Contact dermatitis II. Clinical aspects and diagnosis. *Eur. J. Dermatol.* 1999; 9 (2): 144-159.

6. Apfelbacher C., Bewley A., Molin S., et al. Prevalence of chronic hand eczema in adults: a cross-sectional survey of over 60 000 respondents from the general population of Canada, France, Germany, Italy, Spain and the UK. *Br. J. Dermatol*. 2025; 192 (6): 1047-1054. https://doi.org/10.1093/bjd/ljaf020

7. Yüksel Y.T., Thyssen J.P., Nørreslet L.B., Flachs E.M., Ebbehøj N.E., Agner T. A comparison between self-reported hand eczema and self-reported signs and symptoms of skin lesions indicating hand eczema. *Contact Dermatitis*. 2022; 87 (6): 528-534. https://doi.org/10.1111/cod.14183

8. Gade A., Matin T., Rubenstein R. *Xeroderma.* https://www.ncbi.nlm.nih.gov/books/NBK565884/

9. Parker J., Scharfbillig R., Jones S. Moisturisers for the treatment of foot xerosis: a systematic review. *J. Foot Ankle Res.* 2017; 10: 9. https://doi.org/10.1186/s13047-017-0190-9

10. Augustin M., Wilsmann-Theis D., Körber A., Kerscher M., Itschert G., Dippel M., Staubach P. Diagnosis and treatment of xerosis cutis – a position paper. *J. Dtsch. Dermatol. Ges.* 2019; 17 (7): 3-33. https://doi.org/10.1111/ddg.13906

11. Vestergaard C., Torrelo A., Christen-Zaech S. Clinical Benefits of Basic Emollient Therapy for the Management of Patients With Xerosis Cutis. *Int. J. Dermatol.* 2025; 64 (1): 47-52. https://doi.org/10.1111/ijd.17792

12. Moncrieff G., Cork M., Lawton S., Kokiet S., Daly C., Clark C. Use of Emollients in Dry-Skin Conditions: Consensus Statement. *Clin. Exp. Dermatol.* 2013; 38 (3): 231-238. https://doi.org/10.1111/ced.12104

13. Pons-Guiraud A. Dry skin in dermatology: a complex physiopathology. *J. Eur. Acad. Dermatol. Venereol.* 2007; 21 (2): 1-4. https://doi.org/10.1111/j.1468-3083.2007.02379.x

14. Korecka K., Pogorzelska-Dyrbuś J., Polańska A., Dańczak-Pazdrowska A., Lallas A. Magnified Dermoscopy in Skin Cancer and Infectious Skin Diseases. *Medicina (Kaunas)*. 2025; 61 (11): 1970. https://doi.org/10.3390/medicina61111970

15. Campos-do-Carmo G., Ramos-e-Silva M. Dermoscopy: basic concepts. *Int. J. Dermatol.* 2008; 47 (7): 712-719. https://doi.org/10.1111/j.1365-4632.2008.03556.x

16. Crowther J.M. Method for quantification of oils and sebum levels on skin using the Sebumeter®. *Int. J. Cosmet. Sci.* 2016; 38 (2): 210-216. https://doi.org/10.1111/ics.12258

17. Gidado I.M., Nwokoye I.I., Triantis I.F., Qassem M., Kyriacou P.A. Multi-Modal Spectroscopic Assessment of Skin Hydration. *Sensors (Basel).* 2024; 24 (5): 1419. https://doi.org/10.3390/s24051419

18. Boer M., Duchnik E., Maleszka R., Marchlewicz M. Structural and biophysical characteristics of human skin in maintaining proper epidermal barrier function. *Adv. Dermatol. Allergol.* 2016; 33 (1): 1-5. https://doi.org/10.5114/pdia.2015.48037

19. Bhattacharya N., Sato W.J., Kelly A., Ganguli-Indra G., Indra A.K. Epidermal Lipids: Key Mediators of Atopic Dermatitis Pathogenesis. *Trends. Mol. Med.* 2019; 25 (6): 551-562. https://doi.org/10.1016/j.molmed.2019.04.001

20. Martinsen Ø., Grimnes S. Long-Term Effect of Some Skin Moisturizers. *Open Dermatol. J.* 2008; 2: 87-89. https://doi.org/10.2174/1874372200802010087

21. Barnes T.M., Mijaljica D., Townley J.P., Spada F., Harrison I.P. Vehicles for Drug Delivery and Cosmetic Moisturizers: Review and Comparison. *Pharmaceutics*. 2021; 13 (12): 2012. https://doi.org/10.3390/pharmaceutics13122012

22. Lodén M., Hagforsen E., Lindberg M. The presence of body hair influences the measurement of skin hydration with the Corneometer. *Acta Derm. Venereol.* 1995; 75 (6): 449-450. https://doi.org/10.2340/0001555575449450

23. Ehlers C., Ivens U.I., Møller M.L., Senderovitz T., Serup J. Comparison of two pH meters used for skin surface pH measurement: the pH meter 'pH900' from Courage & Khazaka versus the pH meter '1140' from Mettler Toledo. *Skin Res. Technol.* 2001; 7 (2): 84-89. https://doi.org/10.1034/j.1600-0846.2001.70205.x

24. Prakash C., Bhargava P., Tiwari S., Majumdar B., Bhargava R.K. Skin Surface pH in Acne Vulgaris: Insights from an Observational Study and Review of the Literature. *J. Clin. Aesthet. Dermatol.* 2017; 10 (7): 33-39.

25. Luebberding S, Krueger N, Kerscher M. Skin physiology in men and women: in vivo evaluation of 300 people including TEWL, SC hydration, sebum content and skin surface pH. *Int. J. Cosmet. Sci.* 2013; 35 (5): 477-483. https://doi.org/10.1111/ics.12068

26. Errichetti E., Stinco G. Dermoscopy in General Dermatology: A Practical Overview. *Dermatol Ther (Heidelb).* 2016; 6 (4): 471-507. https://doi.org/10.1007/s13555-016-0141-6

27. Errichetti E., Stinco G. Dermoscopy in differential diagnosis of palmar psoriasis and chronic hand eczema. *J. Dermatol.* 2016; 43 (4): 423-425. https://doi.org/10.1111/1346-8138.13142

28. Errichetti E., Stinco G. Dermoscopy as a supportive instrument in the differentiation of the main types of acquired keratoderma due to dermatological disorders. *J. Eur. Acad. Dermatol. Venereol.* 2016; 30 (6): e229-e231. https://doi.org/10.1111/jdv.13566

29. Weisshaar E. Chronic Hand Eczema. *Am. J. Clin. Dermatol.* 2024; 25 (6): 909-926. https://doi.org/10.1007/s40257-024-00890-z

30. Thyssen J.P., Schuttelaar M.L.A., Alfonso J.H., et al. Guidelines for diagnosis, prevention, and treatment of hand eczema. *Contact Dermatitis.* 2022; 86 (5): 357-378. https://doi.org/10.1111/cod.14035

31. Kuriyama S., Kasuya A., Fujiyama T., Tatsuno K., Sakabe J., Yamaguchi H., Ito T., Tokura Y. Leukoderma in patients with atopic dermatitis. *J. Dermatol.* 2015; 42 (2): 215-218. https://doi.org/10.1111/1346-8138.12746

32. Hu S.C., Lin C.L., Yu H.S. Dermoscopic assessment of xerosis severity, pigmentation pattern and vascular morphology in subjects with physiological aging and photoaging. *Eur. J. Dermatol.* 2019; 29 (3): 274-280. doi: https://doi.org/10.1684/ejd.2019.3555

33. Molin S., Guttman-Yassky E., Thyssen J.P., Bewley A. Chronic Hand Eczema, Real World, and Patient Centricity: A Narrative Review. *Acta Derm. Venereol.* 2025; 105: adv42596. https://doi.org/10.2340/actadv.v105.42596

34. Weidinger S., Novak N. Hand eczema. *Lancet*. 2024; 404 (10470): 2476-2486. https://doi.org/10.1016/S0140-6736(24)01810-5

35. Grant L., Seiding Larsen L., Burrows K., et al. Development of a Conceptual Model of Chronic Hand Eczema (CHE) Based on Qualitative Interviews with Patients and Expert Dermatologists. *Adv. Ther.* 2020; 37 (2): 692-706. https://doi.org/10.1007/s12325-019-01164-5

Received 17.02.2026
Sent for revision 21.03.2026
Accepted 13.04.2026
Published online 30.06.2026

*Т. Б. Ибраева[1]*, З. Жетписбаева[1], А. Т. Нурмухамбетова[1], Н. Ж. Рамазанова[1], Б. Ерболаткызы[1]*

## СРАВНИТЕЛЬНАЯ МОРФО-ФУНКЦИОНАЛЬНАЯ ОЦЕНКА КОЖИ ПРИ ЭКЗЕМЕ И КСЕРОЗЕ: РОЛЬ НЕИНВАЗИВНОЙ ДЕРМАТОСКОПИИ И БИОИНЖЕНЕРНЫХ МЕТОДОВ

[1]Кафедра дерматовенерологии и дерматокосметологии, НАО «Медицинский университет Астана» (100000, Республика Казахстан, г. Астана, ул. Бейбитшилик, 49а; e-mail: mail@amu.kz)

***Торгын Берикжановна Ибраева** – Кафедра дерматовенерологии и дерматокосметологии, НАО «Медицинский университет Астана»; 100000, Республика Казахстан, г. Астана, ул. Бейбитшилик, 49а; e-mail: ibraeva.t@amu.kz

*Введение.* Дерматоскопия и биоинженерные методы являются высокоценными неинвазивными диагностическими инструментами, используемыми для дифференциальной диагностики экземы и ксероза, часто имеющих схожие клинические признаки. Хотя обе патологии характеризуются сухостью кожи, их морфологическая и функциональная природа существенно различается.

*Цель.* Сравнительная характеристика дерматоскопических признаков и биофизических показателей экземы и ксероза, изучение морфофункциональных особенностей экземы и ксероза кожи и выявление объективных критериев дифференциальной диагностики этих патологий на основе дерматоскопических признаков и биофизических показателей (корнеометрия, себометрия, pH-метрия).

*Материалы и методы.* В исследовании приняли участие 32 пациента с экземой и 27 пациентов с ксерозом. Был применен комплексный диагностический подход: морфологические изменения изучались с помощью поляризованной дерматоскопии, а функциональное состояние кожи оценивалось посредством pH-метрии, корнеометрии (измерение влажности) и себометрии (оценка уровня липидов).

*Результаты и обсуждение.* При дерматоскопии для экземы были характерны желтоватые чешуйки и беспорядочное расположение точечных сосудов, в то время как тонкие белые чешуйки и аваскулярный фон были основными маркерами ксероза. Функциональный анализ выявил значительно более низкие уровни гидратации кожи и липидов в группе ксероза, а также изменения значений pH поверхности кожи. Согласно индексу Юдена, аваскулярный фон, дефицит липидов и данные pH-метрии имели наибольшее значение в уточнении диагноза ксероза.

*Выводы*. Сочетание дерматоскопии с результатами pH-метрии, корнеометрии и себометрии позволяет объективно оценить «кислотную мантию» и функциональное состояние кожи, обеспечивая тем самым высокоточную дифференциацию между экземой и ксерозом.

*Ключевые слова:* дерматоскопия; экзема; ксероз; биоинженерия; концентрация водородных ионов

*Т. Б. Ибраева[1]*, З. Жетписбаева[1], А. Т. Нұрмұхамбетова[1], Н. Ж. Рамазанова[1], Б. Ерболатқызы[1]*

**ЭКЗЕМА ЖӘНЕ КСЕРОЗ КЕЗІНДЕГІ ТЕРІНІ САЛЫСТЫРМАЛЫ МОРФО-ФУНКЦИОНАЛДЫҚ БАҒАЛАУ: ИНВАЗИВТІ ЕМЕС ДЕРМАТОСКОПИЯ МЕН БИОИНЖЕНЕРЛІК ӘДІСТЕРДІҢ РӨЛІ**

[1]«Астана медицина университеті» КеАҚ, дерматовенерология және дерматокосметология кафедрасы (100000, Қазақстан Республикасы, Астана қ., Бейбітшілік к-сі, 49а; e-mail: mail@amu.kz)

***Торғын Берікжанқызы Ибраева** – «Астана медицина университеті» КеАҚ, дерматовенерология және дерматокосметология кафедрасы; 100000, Қазақстан Республикасы, Астана қ., Бейбітшілік к-сі, 49а; e-mail: ibraeva.t@amu.kz

*Өзектілігі.* Дерматоскопия мен биоинженерлік әдістер — клиникалық көріністері ұқсас болып келетін экзема мен ксерозды ажырату үшін қолданылатын құнды инвазивті емес диагностикалық құралдар. Екі патология да терінің құрғауымен сипатталғанымен, олардың морфологиялық және функционалдық табиғаты айтарлықтай ерекшеленеді.

*Мақсат.* Экзема мен ксероздың дерматоскопиялық белгілері мен биофизикалық көрсеткіштерінің салыстырмалы сипаттамасы, экзема мен тері ксерозының морфофункционалды ерекшеліктерін зерттеу және дерматоскопиялық белгілер мен биофизикалық көрсеткіштер (корнеометрия, себометрия, pH-метрия) негізінде осы патологияларды дифференциалды диагностикалаудың объективті критерийлерін анықтау.

*Материалдар және әдістер.* Зерттеуге экземасы бар 32 пациент және ксерозы бар 27 пациент қатысты. Кешенді диагностикалық тәсіл қолданылды: морфологиялық өзгерістер поляризацияланған дерматоскопия көмегімен зерттелді, ал терінің функционалдық жағдайы pH-метрия, корнеометрия (ылғалдылықты өлшеу) және себометрия (липидтер деңгейін бағалау) арқылы бағаланды.

*Нәтижелер және талқылау.* Дерматоскопия кезінде экземаға сарғыш қабыршақтар мен нүктелі тамырлардың ретсіз орналасуы тән болса, ксероздың негізгі маркерлері ретінде жұқа ақ қабыршақтар мен аваскулярлық (тамырсыз) фон анықталды. Функционалдық талдау ксероз тобында тері гидратациясы мен липидтер деңгейінің айтарлықтай төмен екенін, сондай-ақ тері бетінің pH көрсеткіштерінің өзгергенін көрсетті. Юден индексіне сәйкес, ксероз диагнозын нақтылауда аваскулярлық фон, липидтер тапшылығы және pH-метриялық мәліметтер ең жоғары маңызға ие болды.

*Қорытынды.* Дерматоскопияны pH-метрия, корнеометрия және себометрия нәтижелерімен ұштастыру терінің «қышқылдық мантиясын» және функционалдық жағдайын объективті бағалауға, сол арқылы экзема мен ксерозды жоғары дәлдікпен ажыратуға мүмкіндік береді.

*Кілт сөздер:* дерматоскопия; экзема; ксероз; биоинженерия; сутек иондарының-ион концентрациясы