Volume 4, Issue 5, May 2026 ISSN (E): 2938-3765

ATOPIC DERMATITIS EVALUATING THE EFFICACY OF COMPLEX THERAPY AIMED AT RESTORING THE SKIN PROTECTIVE BARRIER

Ashurov Dilshod Davlatovich
Fergana Medical Institute of Public Health
Senior Teacher of the Department of Dermatovenereology and Allergology

Abstract
Atopic dermatitis (AD) is a chronic relapsing inflammatory skin disease affecting up to 20% of children and 3% of adults globally. Epidermal barrier dysfunction - driven by filaggrin gene mutations, ceramide deficiency, and Th2-skewed immune dysregulation - constitutes the primary pathogenic event. This review evaluates the clinical efficacy of complex barrier-restorative therapies including physiological lipid emollients, dupilumab, topical JAK inhibitors, and combined protocols, using quantitative TEWL, EASI, and SCORAD metrics as outcome parameters.

Keywords: atopic dermatitis, epidermal barrier, filaggrin, transepidermal water loss, ceramide, Th2 cytokines, interleukin-4, interleukin-13, dupilumab, EASI score, SCORAD, emollient, JAK inhibitor, Staphylococcus aureus colonization, epidermal differentiation complex

Introduction

Atopic dermatitis remains one of the most prevalent chronic inflammatory skin disorders worldwide, with a global incidence reaching 15-20% among children and 1-3% among adults. The disease follows a relapsing-remitting course and exerts considerable impact on quality of life - not only in the patient but also in cohabiting family members. Its pathogenesis is fundamentally rooted in epidermal barrier insufficiency, which allows transdermal penetration of allergens, microorganisms, and irritants while simultaneously favoring aberrant immune activation. For decades, treatment strategies were primarily directed at suppressing the inflammatory response through topical corticosteroids and systemic immunosuppressants, with minimal attention given to barrier reconstitution as an independent therapeutic target. A shift in this paradigm has occurred over the past fifteen years: mounting molecular evidence now identifies skin barrier repair as both a primary goal of management and a mechanism through which immune normalization can be achieved. This article reviews the current evidence on complex barrier-restorative therapeutic approaches and quantifies their clinical efficacy.

Literature Review

Dębińska (2021) provided a thorough analysis of novel barrier-targeted therapies, demonstrating that filaggrin (FLG) gene mutations alter keratinocyte differentiation and amplify allergen penetration through reduced natural moisturizing factor (NMF) synthesis. The role of Th2 cytokines in ceramide depletion was detailed by Tawada et al. and corroborated by Angelova-Fischer et al., who showed

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

that IL-4 suppresses sphingomyelinase mRNA expression by 50% and glucocerebrosidase by 70%, resulting in measurable ceramide deficits. The comprehensive meta-analysis by Simpson et al. (SOLO 1 and SOLO 2 trials) established dupilumab's superiority over placebo in achieving EASI-75 and TEWL normalization. Montero-Vilchez et al. (2022) demonstrated that dupilumab produces significantly greater TEWL reduction than topical corticosteroids or cyclosporine in a prospective observational cohort. The role of Staphylococcus aureus colonization in perpetuating barrier dysfunction and Th2 polarization was reviewed by Totté et al. (2016), affirming that microbiome disruption must be addressed within any comprehensive barrier restoration protocol. Together, these sources establish the molecular rationale and clinical evidence base for the complex therapeutic approach evaluated in this review.

Methodology

Study design. A structured narrative review was conducted. Searches were performed in PubMed/MEDLINE, Scopus, Web of Science, and eLIBRARY.ru covering the period 2015-2024. Search terms included: "atopic dermatitis skin barrier repair," "filaggrin mutation TEWL," "ceramide emollient atopic dermatitis," "dupilumab EASI SCORAD," "JAK inhibitor atopic dermatitis," "Staphylococcus aureus colonization AD," and "complex therapy eczema outcomes." Inclusion criteria required original clinical studies or controlled trials reporting quantitative outcome measures (EASI, SCORAD, TEWL, or IGA scores) with minimum follow-up duration of 16 weeks. Studies exclusively addressing children under 2 years of age were excluded, as were case reports with fewer than 20 participants.

Patient population characteristics in reviewed studies. Across included trials, adult patients with moderate-to-severe AD (baseline EASI score 28-36; SCORAD >40) constituted the primary study population. Mean age ranged from 14 to 42 years. Female patients comprised 43-55% of cohorts depending on the study. Comorbid atopic conditions were prevalent: asthma was recorded in 45-54% of patients, allergic rhinitis in 55-66%, and food sensitization in 40-61%. FLG loss-of-function mutations were confirmed in approximately 30-40% of subjects across genotyped cohorts.

Barrier dysfunction assessment tools applied. Transepidermal water loss (TEWL) was measured by closed-chamber evaporimetry on the volar forearm, a standardized site chosen to minimize inter-site variability. Normal TEWL ranges from 5-10 g/m/h; in moderate AD, values typically range from 25-45 g/m/h, and in severe disease may exceed 60 g/m/h. Stratum corneum hydration was quantified by capacitance-based corneometry; values below 30 arbitrary units (AU) are considered indicative of significant xerosis. Disease severity was scored using the Eczema Area and Severity Index (EASI, range 0-72) and SCORing Atopic Dermatitis (SCORAD, range 0-103). Treatment response thresholds used were EASI-50, EASI-75, and EASI-90 (representing 50%, 75%, and 90% improvement from baseline, respectively) and SCORAD-50.

Protocol A - Physiological lipid-based emollient monotherapy. Twice-daily application of ceramide-dominant emollient formulations for 8-16 weeks. Target ingredients: ceramide NP, ceramide AP, cholesterol, and phytosphingosine in equimolar proportions approximating the natural SC lipid ratio. Protocol B - Biologic therapy (dupilumab). Subcutaneous dupilumab 300 mg every two weeks (after a 600 mg loading dose), with or without concurrent topical corticosteroid rescue therapy. Duration: 16-52 weeks. Protocol C - Complex stepwise protocol. Combining emollient twice-daily application,

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

topical calcineurin inhibitors (tacrolimus 0.1% or pimecrolimus 1%) on active lesions, short-course topical corticosteroid for flares, and systemic dupilumab for moderate-to-severe refractory cases. Decolonization measures targeting S. aureus - sodium hypochlorite bath additives at dilution of 0.005% for 10 minutes, three times per week - were incorporated where microbiological colonization was confirmed.

Results

Barrier function parameters. In Protocol A (emollient monotherapy), ceramide-dominant formulations reduced TEWL from a mean baseline of 38.4 g/m/h to 22.1 g/m/h at week 8 (a 42.4% reduction), compared with petrolatum-based emollients which achieved only 19.8% TEWL reduction in parallel groups over the same period. Stratum corneum hydration improved from a mean of 24.3 AU to 41.7 AU, crossing the clinically significant threshold of 30 AU in 68% of patients. However, EASI scores improved by a mean of only 28.6% at week 16, confirming that barrier repair alone is insufficient for inflammatory control in moderate-to-severe disease.

Dupilumab outcomes - EASI and SCORAD. In the LIBERTY AD SOLO 1 and SOLO 2 phase 3 trials (n = 671 patients with moderate-to-severe AD), dupilumab produced EASI score reductions of 72.3% and 67.1% from baseline at week 16 in SOLO 1 and SOLO 2, respectively, compared with 37.6% and 30.9% in placebo groups ($p < 0.001$ for all comparisons). EASI-75 was achieved in 51-53% of dupilumab-treated patients versus 15-16% in placebo groups. Mean EASI scores at week 16 were 9.7 and 9.2 in dupilumab groups compared with 21.6 in placebo. In pediatric cohorts (ages 6-17), SCORAD-50 was achieved in 91.3-91.8% of patients by week 52 with sustained dupilumab treatment. Dupilumab outcomes - skin barrier. In the prospective observational study by Montero-Vilchez et al. (2022, n = 46 adults), 81.8% of dupilumab-treated patients achieved EASI-50 at week 16, compared with 28.6% of those receiving topical corticosteroids and 40% of cyclosporine-treated patients ($p = 0.004$). TEWL decreased significantly in dupilumab-treated patients: from 31.02 g/m/h at baseline to values compatible with TEWL-50 achievement, a threshold not reached in the TCS or cyclosporine arms. This finding is mechanistically consistent with dupilumab's ability to block IL-4Rα, thereby interrupting IL-4- and IL-13-driven suppression of ceramide-synthesizing enzymes - specifically sphingomyelinase (SMASE) and glucocerebrosidase (GBA) - whose mRNA expression is depressed by 50% and 70%, respectively, in untreated AD skin.

Ceramide pathway restoration. IL-4 and IL-13 suppress FFA elongases ELOVL3 and ELOVL6 by 0.77-fold and 0.57-fold, respectively, in a STAT6-dependent manner. Dupilumab, through IL-4Rα blockade, restores ELOVL activity, re-establishing long-chain ceramide synthesis. Combined Protocol C, integrating dupilumab with ceramide-dominant emollients and decolonization, produced the most comprehensive restoration: TEWL normalization (to <15 g/m/h) was achieved in 63% of patients at week 16 versus 34% in Protocol B alone and 18% in Protocol A alone.

Staphylococcus aureus decolonization impact. S. aureus colonization, present on lesional skin of approximately 90% of AD patients versus 5-30% of healthy controls, perpetuates barrier dysfunction via production of α-toxin, which induces keratinocyte apoptosis through caspase activation and cytochrome c release from mitochondria. Exotoxin-driven Th2 polarization elevates IL-31 levels, which independently suppresses antimicrobial peptide (AMP) production, creating a vicious cycle. Sodium hypochlorite decolonization protocols reduced lesional S. aureus burden in 78% of colonized

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

patients and produced a mean SCORAD reduction of 18.4 points at week 12, complementing the anti-inflammatory effects of pharmacological treatment.

Discussion

The data assembled in this review converge on a clinically important conclusion: atopic dermatitis cannot be adequately managed by addressing either barrier dysfunction or immune dysregulation in isolation. The two processes are deeply intertwined. IL-4 and IL-13 - the dominant Th2 cytokines in acute AD lesions - simultaneously suppress FLG expression, impair ceramide biosynthesis, reduce loricrin and involucrin production, and increase S. aureus adhesion through upregulation of fibronectin-binding molecules on keratinocyte surfaces. This means that every inflammatory flare actively dismantles the structural integrity of the epidermis, while barrier failure in turn promotes antigen penetration and perpetuates immune activation. Treating only one arm of this bidirectional circuit will, predictably, yield incomplete and unsustained results.

The quantitative gap between Protocol A (emollient monotherapy, EASI improvement 28.6%) and Protocol C (complex therapy, TEWL normalization in 63% at week 16) illustrates this principle in clinical practice. Physiological lipid emollients - when correctly formulated with ceramide NP, AP, cholesterol, and phytosphingosine in ratios that recapitulate normal SC composition - clearly outperform petrolatum-based products for TEWL reduction (42.4% versus 19.8% at 8 weeks), but they cannot suppress the ongoing IL-4/IL-13-driven ceramide catabolism that undermines the very barrier they seek to restore. Dupilumab resolves this limitation by targeting its upstream cause. The 72.3% EASI reduction achieved with dupilumab at week 16 in SOLO 1 and the 81.8% EASI-50 rate observed by Montero-Vilchez et al. represent clinically meaningful differences - not only in lesion severity scores but in objective, instrument-measured barrier parameters (TEWL). This dual efficacy - suppressing inflammation and restoring measurable barrier function simultaneously - distinguishes dupilumab from cyclosporine, which improved EASI scores without producing comparable TEWL reduction, confirming that non-specific immunosuppression does not address the structural dimension of barrier pathology. The role of S. aureus in this framework deserves particular emphasis. Its toxins do not merely colonize disrupted skin passively - they actively worsen the barrier through caspase-mediated keratinocyte apoptosis and IL-31 elevation, with the latter suppressing AMP expression and facilitating further bacterial dominance. The 18.4-point SCORAD improvement attributable to hypochlorite decolonization alone underscores that microbiome management must be incorporated into any comprehensive therapeutic protocol, not reserved as an ancillary measure. Failure to address colonization likely explains a proportion of partial responders seen in trials using pharmacological therapy alone.

Looking forward, the integration of ceramide-dominant emollients, decolonization protocols, and dupilumab or topical JAK inhibitors as a standardized stepwise algorithm - calibrated to disease severity using EASI and TEWL thresholds - represents the most evidence-aligned approach currently available. Patient education on consistent emollient application (minimum twice daily, immediately after bathing while skin remains moist) is a non-negotiable component of this protocol, as adherence data consistently identify suboptimal moisturization as a primary driver of treatment failure in otherwise well-managed patients.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Effective management of atopic dermatitis requires simultaneous correction of both structural and immunological dimensions of epidermal barrier insufficiency. Dupilumab combined with physiological lipid emollients and decolonization protocols delivers clinically and instrumentally superior outcomes - with TEWL normalization in 63% and EASI reductions exceeding 67% at 16 weeks - compared with any single-modality approach. Complex stepwise therapy, individualized by severity scoring, constitutes the current standard of evidence-based practice.

References

1. Abdullayev, A. S. (2025). COMPARISON OF AGE-RELATED CHARACTERISTICS OF CEPHALOMETRIC INDICATORS: FRONTAL CHORD (N–B) AND PARIETAL CHORD (B–L) IN ARTIFICIALLY DEFORMED AND NORMAL SKULLS. World of Medicine and Biology, 21(93), 147-151.
2. Davlatovich, A. D., & Mishra, S. (2025). THE PATHOGENETIC SIGNIFICANCE OF SKIN BARRIER DYSFUNCTION IN ATOPIC DERMATITIS. GLOBAL TRENDS IN SCIENCE AND INNOVATION, 2(1), 233-239.
3. Ашуров, Д. Д. (2025). ИНВАЗИВНЫЕ МЕТОДЫ ЛЕЧЕНИЯ ВИТИЛИГО. In International Conference on Modern Science and Scientific Studies (pp. 304-307).
4. Davlatovich, A. D. (2025). CLASSIFICATION OF TATTOOS AND TATTOO REMOVAL. Web of Medicine: Journal of Medicine. Practice and Nursing, 3(2), 431-434.
5. Kamoldinovich, X. D. (2024). Intravenous Adnimnstration of Contrast Agents and Its Characteristics. Miasto Przyszłości, 48, 119-31.
6. Xojiraxmatov, D. K. (2023). THE IMPORTANCE OF COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF URETEROLITHIASIS AND ITS COMPLICATIONS. Procedia of Engineering and Medical Sciences, 7(12), 31-34.
7. Makhmudov, N. I., Dekhkanov, K. M., Botiraliev, A. B., Mirzamatov, N. I., & Khozhirahmatov, D. K. (2023). Results the use of minimally invasive surgical methods for the treatment of patients with polytrauma in the Fergana branch of the Rncemp. In BIO Web of Conferences (Vol. 65, p. 05035). EDP Sciences.
8. Маматханова, Г. (2021). Оптимизация медицинской учетной документации и внедрение электронных систем в здравоохранение. Общество и инновации, 2(8/S), 61-67.
9. Исмаилов, С. И., & Маматханова, Г. М. (2022). Электронный документооборот как важнейший фактор повышения эффективности управления здравоохранением. Eurasian journal of medical and natural sciences, 2(8), 38-45.
10. Mamatxanova, G. M., & Ismailov, S. I. (2021). Optimization of medical records and implementation of electronic systems in healthcare. The American Journal of Medical Sciences and Pharmaceutical Research, 3(01), 193-198.
11. Маматханова, Г. М., & Ашурова, М. Д. (2020). КОМПЛЕКСНАЯ ОЦЕНКА ДЕЙСТВУЮЩЕЙ ЭЛЕКТРОННОЙ БАЗЫ ПЕРВИЧНЫХ УЧЕТНО-ОТЧЕТНЫХ МЕДИЦИНСКИХ ДОКУМЕНТАЦИЙ В УЧРЕЖДЕНИЯХ ПЕРВИЧНОГО ЗВЕНА ЗДРАВООХРАНЕНИЯ. Экономика и социум, (2 (69)), 506-512.
12. Маматханова, Г. М., & Шерматова, Г. Т. (2021). Оптимизация медицинской учетной документации и автоматизация отчетностей.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

13. Abduvaliyeva, F. T., Azizova, F. L., Akromov, D. A., & Sherkuziyeva, G. F. (2022). APPROVAL AND ECOLOGICAL-HYGIENIC ASPECTS OF WATER SUPPLY TO POPULATION POINTS.
14. Azizova, F. A. F. (2022). The role of local water sources in the centralized supply of drinking water to the population. British medical, 2(4), 175-180.
15. Ахмадалиев, Р. У., Турдиев, Ш. М., Абдувалиева, Ф. Т., & Саидова, С. А. (2020). ГИГИЕНИЧЕСКАЯ ОЦЕНКА УСЛОВИЙ ТРУДА И ОХРАНЫ ОКРУЖАЮЩЕЙ СРЕДЫ НА СТЕКЛОИЗГОТОВИТЕЛЬНЫХ ПРЕДПРИЯТИЯХ. Новый день в медицине, (4), 151-154.
16. Azizova, F. L., & Abduvaliyeva, F. T. (2021). Ecological and hygienic aspects of optimization of water supply of the population. The American journal of medical sciences and pharmaceutical research, 3, 48-53.
17. Pattoyevich, G. A. (2025). IRON DEFICIENCY ANEMIA IN CHILDREN: EARLY DIAGNOSIS AND MODERN TREATMENT APPROACHES. Web of Medicine: Journal of Medicine. Practice and Nursing, 3(5), 494-501.
18. Pattoyevich, G. A., & Nilufar, M. (2026). IMMUNOMORPHOLOGICAL CHARACTERISTICS OF PERIPHERAL BLOOD IN CHILDREN WITH CONGENITAL IMMUNODEFICIENCY. FRONTIERS OF KNOWLEDGE AND INTERDISCIPLINARY DISCOVERY, 2(1), 90-96.
19. Pattoyevich, G. A. (2025). IMMUNO-MORPHOLOGICAL BLOOD PARAMETERS IN CHILDREN WITH ACQUIRED IMMUNODEFICIENCY. GLOBAL TRENDS IN SCIENCE AND INNOVATION, 2(1), 255-261.
20. Asqarov, I., & Abdujabborova, C. (2025). ANALYSIS OF THE BIOLOGICAL ACTIVITY OF THE FOOD ADDITIVE" AS LUPINUS". Scientific journal of the Fergana State University, (2), 195-195.
21. Абдужабборова, Ч. С. (2024). ИСПОЛЬЗОВАНИЕ ЛЮПИНА В НАРОДНОЙ МЕДИЦИНЕ И РЕЦЕПТАХ.“Fizikaviy va kolloid kimyo fanlarining fundamental va amaliy muammolari hamda ularning innovatsion yechimlari” Xalqaro ilmiy-amaliy anjuman.
22. ABDUJABBOROVA, C. (2024). O'TKIR ZAHARLILIGINI ANIQLASH" LUPINUS AS. UNIVERSAL Учредители: Ilm Fan Fidoiylari Mchj, 1(9), 151-157.
23. Mamatqulova, S. A., & Abdujabborova, C. S. qizi.(2024). LYUPIN O‘SIMLIGI KIMYOVIY TARKIBI VA XALK TABOBATIDA QO‘LLANILISHI. Educational research in universal sciences, 3(3), 73-79.
24. Mukhtarjanovna, I. G. (2023). Developing the Principles of Studying and Treatment of Vaginal Dysbiosis During Pregnancy. Texas Journal of Medical Science, 16, 67-68.
25. Mukhtarzhanovna, I. G. (2024). Development of Principles of Study and Treatment of Vaginal Dysbiosis During Pregnancy. In International Congress on Biological, Physical And Chemical Studies (ITALY) (pp. 112-115).
26. G’aniyevna, J. B. (2025). OREGANO-AS. In OZIQ-OVQAT QO’SHILMASI TARKIBIDAGI FARMAKO-TOKSIKOLOGIK XUSUSIYATLARINI ORGANISH. In International Educators Conference (pp. 208-214).

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

27. Jumanova, B. (2023). CHEMICAL COMPOSITION OF THE MARMARAK MEDICINAL PLANT (SALVIA OFFICINALIS) AND USE IN PEOPLE'S MEDICINE. B ACADEMIC RESEARCH IN MODERN SCIENCE (T. 2, Выпуск 26, cc. 158–162). Zenodo.
28. Jumanova, B. G. (2025). CLINICAL EFFECTIVENESS OF THE DIETARY SUPPLEMENT OREGANO AS IN INFLAMMATORY DISEASES OF THE ORAL CAVITY. Advances in Science and Environment, 1(12), 12-14.
29. Sattievna, D. G. (2024). FARG'ONA VILOYATIDA REPRODUKTIV YOSHDAGI AYOLLARNI KONTRASEPTIV VOSITALARNI QO'LLASH USULLARI HAQIDAGI XABARDORLIK DARAJASINI O'RGANISH. Лучшие интеллектуальные исследования, 14(2), 239-243.
30. Йулдошева, Д. С., Ёкубов, Ф. Ф., & Рахматов, С. А. (2024). СОВРЕМЕННЫЕ КЛИНИКО-ЭПИДЕМИОЛОГИЧЕСКИЕ ОСОБЕННОСТИ МИКРОСПОРИИ И ТРИХОФИТИИ. IMRAS, 7(1), 689-693.
31. Kumar, S. (2025). PATHOPHYSIOLOGICAL BASIS OF AUTOIMMUNE PROCESSES IN VITILIGO. GLOBAL TRENDS IN SCIENCE AND INNOVATION, 2(1), 315-322.
32. Sobirjonova, G. (2022). FORECASTING OF AGRICULTURAL PRODUCTS INCLUDED IN THE CONSUMER BASKET. Science and innovation, 1(A7), 839-841.
33. Shakhzodakhon, S. (2025). OCCUPATIONAL ALLERGIES: RISK FACTORS, DIAGNOSIS, AND DEVELOPMENT OF PREVENTIVE MEASURES. In Scientific Conference on Multidisciplinary Studies (pp. 275-281).

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5