

NECASA II: A Practical Algorithm Integrating Skincare in the Management of Adult Female Acne in the Nordic European Countries

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ABSTRACT

Background: Adult female acne presents challenges, including increased prevalence, distinct clinical manifestations, heightened skin sensitivity, treatment-related intolerance, and reduced treatment adherence. Integrating skincare into acne management is essential, particularly in Nordic European countries, where environmental factors influence skin physiology. The Nordic European Countries Acne Skincare Algorithm (NECASA) II algorithm serves as an evidence-based practical tool for clinicians in this region to select appropriate skincare based on individual patients' needs to optimize acne care for adult females.

Methods: Dermatologists from six Nordic European countries met to develop the NECASA II algorithm, which builds on the NECASA I framework. The advisors conducted a structured literature review and, combined with their clinical experience, established best practice recommendations for integrating skincare into adult female acne treatment regimens.

Results: The NECASA II algorithm recommends integrating skincare into adult female acne management based on acne severity, subtype, and patient characteristics. The panel concluded that all acne regimens should incorporate a physiologic pH cleanser, an emollient with humectants and lipids, and SPF 50+ sunscreen. Skincare monotherapy is recommended for mild acne, adjunctive skincare for moderate-to-severe acne, and maintenance skincare to prevent relapse following treatment.

Conclusions: Personalized skincare regimens, combined with prescription and nonprescription treatments, can mitigate adverse effects, improve treatment tolerance and adherence, and enhance overall outcomes.

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INTRODUCTION

Acne vulgaris (Acne) is a prevalent inflammatory skin condition that can cause lifelong physical consequences, including dyschromia and scars, leading to social and psychological impacts.¹⁻³ While commonly associated with adolescence, adult acne affects approximately 40% of patients in their 20s and persists into the 30s in almost half of adults.¹ Acne poses a substantial healthcare burden, ranking as the 8th most prevalent disease globally in 2010 and causing 20 years lived with disability per 100,000 people.^{4,5} The socioeconomic impact of acne is evidenced by the US's treatment costs and productivity losses exceeding \$3 billion annually.¹ Acne severely impacts quality of life (QoL) and is associated with low self-esteem, anxiety, depression, suicidal ideation, and

negative emotions, including embarrassment, humiliation, and self-consciousness.^{1,3,6} These effects are amplified in women due to societal pressures related to appearance.^{3,4,6,7} Acne etiology is multifactorial, involving a complex interplay of genetic, hormonal, and environmental factors.⁸⁻¹⁰ While the current understanding of acne pathophysiology is incomplete, key acne-initiating factors include altered sebum production and microbiome dysbiosis, leading to inflammation and follicular hyperkeratinization.^{8,10} Epidermal barrier disruption is a major driver of acne pathogenesis and severity, particularly in adult female acne.^{7,10,11} The epithelial barrier is directly involved in inflammation, comedogenesis, and particularly in follicular rupture.^{10,12,13} Consequently, restoring the epidermal barrier and the microbiome by controlling *Cutibacterium acnes*

(*C acnes*) and *Staphylococcus epidermidis* colonization, sebum production, and inflammation is essential for effective acne management. Acne's clinical presentation and prevalence vary according to skin type and gender.^{2,4,7,14-16}

Adult female acne presents unique challenges, often requiring different treatment strategies to suit individual patients' needs. Acne is more prevalent in adult women than men (63.0% vs 37.0%).² Acne-related sequelae, including dyschromia and scarring, are frequent in adult female acne.² Androgenic activity is a key factor in acne, with increased sensitivity of sebaceous glands to circulating hormones contributing to persistent acne lesions.⁹ Epidermal barrier dysfunction and inflammatory responses may be more pronounced in adult female acne, making the skin more prone to irritation from topical treatments.^{2,11} Clinical manifestations of adult female acne are often characterized by inflammatory papules and nodules concentrated in the lower face, jawline, and neck, with a predisposition to dyschromia and scarring.^{2,9} These features necessitate a comprehensive therapeutic approach that addresses the underlying factors while considering patient characteristics, preferences, and desired treatment outcomes.^{15,16} Many acne therapies, including retinoids, benzoyl peroxide (BPO), antibiotics, and isotretinoin, are associated with epidermal barrier dysfunction and irritation.^{12,13} Growing antibiotic resistance has constrained topical antibiotic treatment for acne, and current clinical practice increasingly escalates acne treatment to low-dose isotretinoin.^{17,18} While treatment with retinoids, BPO, antibiotics, and isotretinoin remains the cornerstone of acne therapy, integrating a skincare regimen is essential for mitigating adverse effects and improving treatment tolerance, adherence, and outcomes.^{7,11,19-22} In Nordic European countries, where environmental factors such as cold temperatures, seasonal variations, and low humidity influence skin physiology, optimizing skincare as part of acne management is particularly relevant. Moreover, skin type should be considered, such as the increased incidence of skin sensitivity and erythema in skin types more prevalent in Nordic European countries (phototypes I-III).^{14,16} Despite the growing recognition of the importance of skincare in acne management, standardized guidance on integrating skincare with prescription and nonprescription treatments remains lacking. A practical algorithm incorporating skincare into the comprehensive management of adult female acne patients was developed to bridge this gap.

MATERIALS AND METHODS

Role of the Panel

Six dermatologists from Nordic European countries (advisors) who treat adult female patients with acne convened on September 27, 2024, during the European Association of Dermatology and Venereology Congress in Amsterdam, Netherlands, to develop a practical algorithm. The Nordic European Countries Acne

Skincare Algorithm (NECASA) II is an evidence-based practical tool for clinicians to select appropriate skincare based on individual patient needs to optimize adult female acne care. The NECASA II algorithm builds upon the NECASA I framework, which aims to minimize adverse effects while enhancing acne treatment tolerance, adherence, and patient outcomes by emphasizing the role of cleansers, emollients, and sun protection.²³ Working in small groups, with information from the literature, the advisors' opinions, and clinical experience, the advisors revised the initial algorithm skeleton and reconvened as a plenary group to reach a consensus through blinded reiterations. Reviewing, editing, customizing the final algorithm, obtaining consensus, and discussing the manuscript took place online.

Literature Review

Before the meeting, literature was compiled on current best practices in acne management in the Nordic European countries, addressing treatment, maintenance, and skincare, including prescription and nonprescription treatment, cleansers, and emollients recommendations for adult female acne. On August 20, 2024, searches were performed on PubMed and Google Scholar by reviewing titles and abstracts followed by full articles. Selected articles included clinical guidelines, algorithms, consensus papers, systematic literature reviews, and clinical studies published in English from January 2010 to August 2024. Publications in languages other than English and those not addressing adult female acne were excluded. Two reviewers (AA and NS) independently evaluated the results of the searches.²⁴ References from selected publications were manually reviewed and graded based on the level of evidence and reviewer consensus. Database searches identified 210 records, of which 42 articles were included (Figure 1).

RESULTS

Algorithm

The NECASA II algorithm recommends integrating skincare, nonprescription, and prescription acne treatments into acne regimens, addressing the relative lack of standardized guidance on skincare, topical, and oral agents (Figure 2). The algorithm is stratified by acne subtype, severity, and maintenance. Ongoing skincare is recommended in all acne regimens, including a gentle (pH 4-6) cleanser, an emollient with lipids or humectants, and SPF 50+ sunscreen, particularly products containing niacinamide and antioxidants. The type of cleanser and emollient should be selected based on individual patient needs.

General Principles of Adult Female Acne Management

Recommendations for Mild, Moderate, and Severe Acne Treatment

Mild acne is characterized by comedonal and up to 2 papular presentations, while moderate acne typically shows papulopustular and nodular presentations (less than 35

FIGURE 1. Results of the structured literature searches.

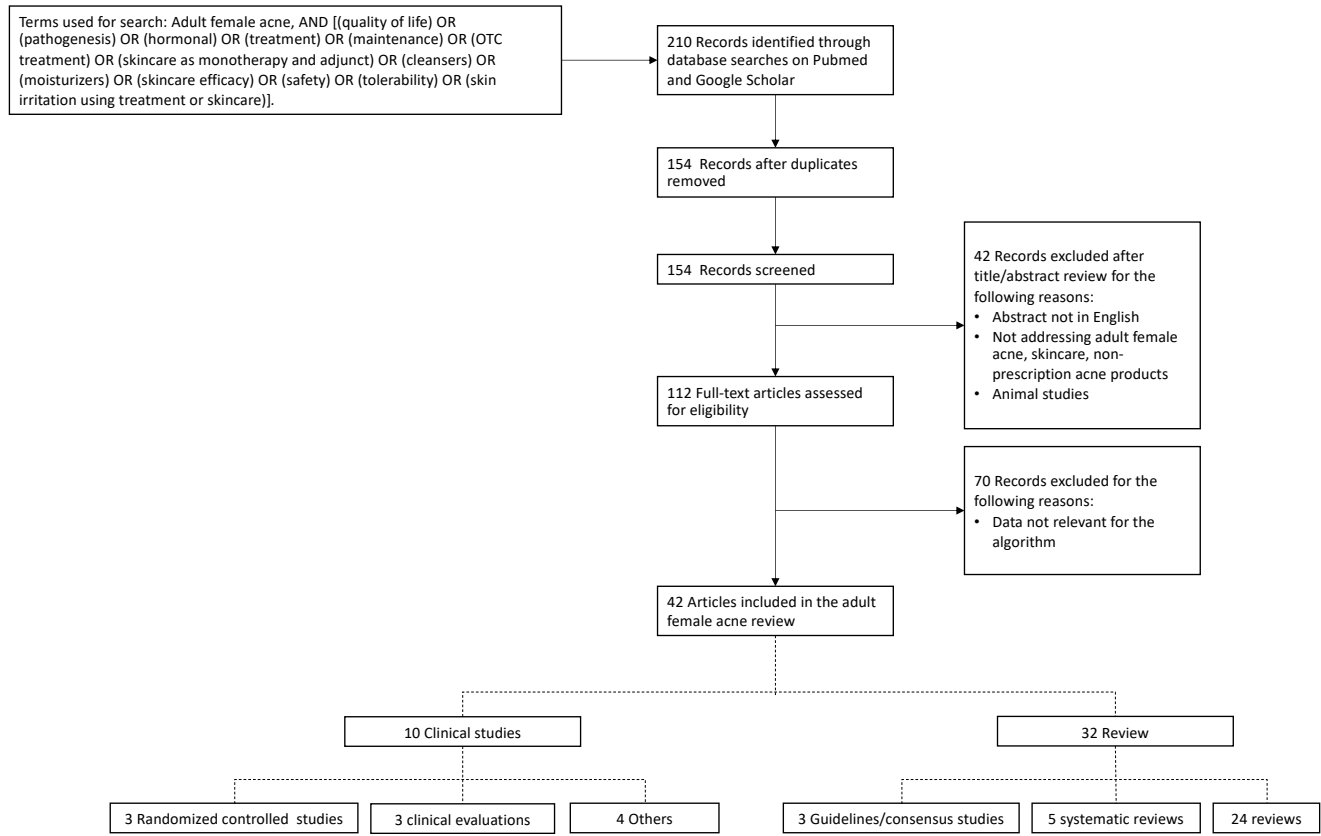
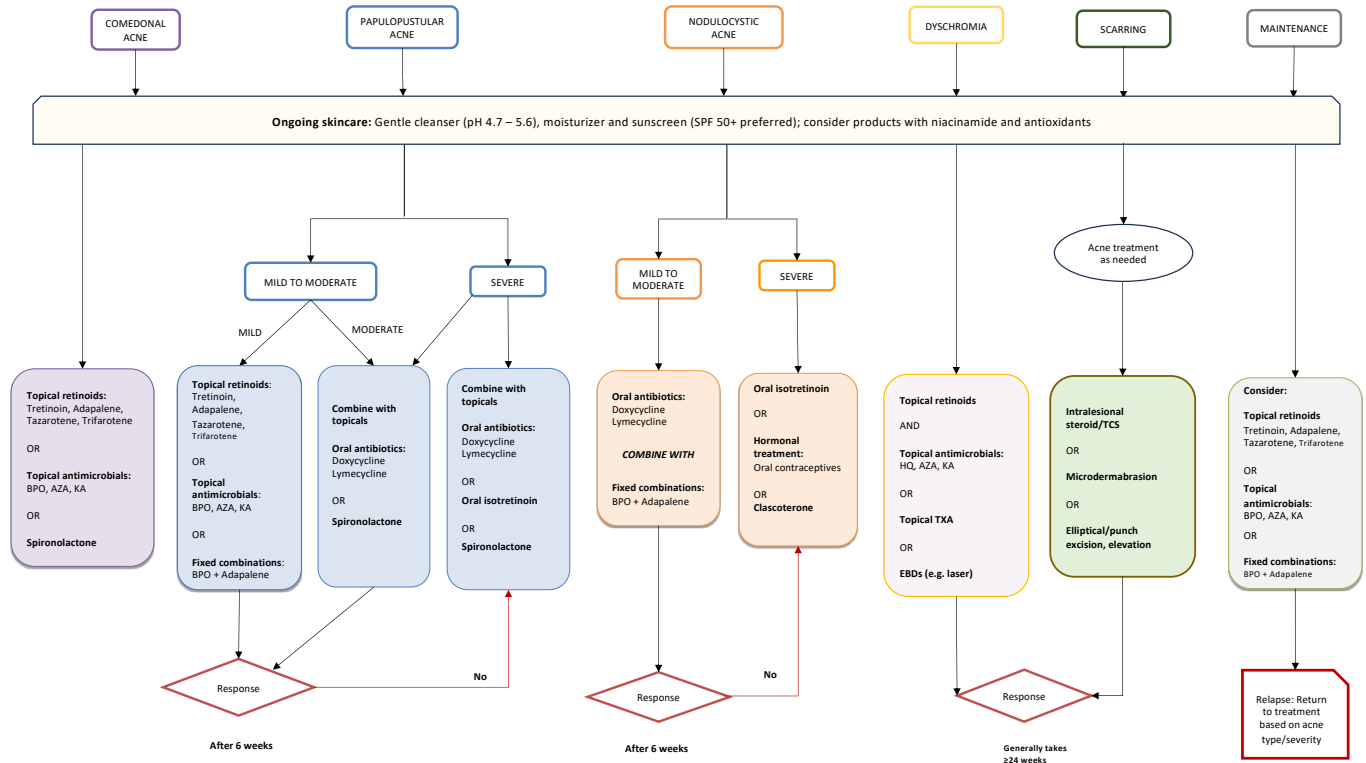


FIGURE 2. NECASA II algorithm integrating skincare into managing adult female acne patients.



AZA = azelaic acid; BPO = benzoyl peroxide; isoT = isotretinoin; KA = kojic acid; TXA = tranexamic acid

TABLE 1.

Nonprescription Topical Acne Treatments		
Type	Formulation	Activity/Effect
Azelaic acid	10%	Dicarboxylic acid
Benzoyl peroxide	2.5%, 5%, 10%	Antibacterial, mild sebostatic, mild keratolytic
Ceramides	1-5%	Epidermal barrier restoring
Glycerin	5-10%	Humectant
Glycolic acid	5%, 10%	Keratolytic, comedolytic
Hyaluronic acid	0.2%	Humectant
Kojic acid	1%, 2%, 4%	Antibacterial, skin lightening
Niacinamide	2-5%	Epidermal barrier restoring, sebum-controlling
Salicylic acid	0.5%, 2%	Keratolytic, comedolytic
Sulphur	3%-8%	It helps absorb excess sebum
Sodium sulfacetamide	10%	Antibacterial
Resorcinol	2%	Antibacterial, mild keratolytic
Zinc sulphate	5-15%	Sebum-controlling, anti-inflammatory

inflammatory lesions), and severe acne commonly presents as nodulocystic and conglobate (35 or more inflammatory lesions and 3 or more nodules). In addition to skincare, the panel recommends nonprescription maintenance options, including azelaic acid and salicylic acid, particularly for patients without access to dermatologists. Other options include topical retinoids (eg, adapalene, tazarotene, tretinoin, and trifarotene) and antimicrobials (eg, benzoyl peroxide [BPO] and 10% azelaic acid; Table 1).^{7,9,15,20,25,26} Severe or diffuse forms of comedonal acne with inflammatory papules and nodules concentrated in the lower face, jawline, and neck in adult female acne may require anti-androgens such as spironolactone (Table 2).⁹

For moderate-to-severe acne, the preferred treatment is skincare adjunctive to a combination of topical retinoids (eg, adapalene), antimicrobials (eg, BPO), and oral antibiotics (eg, doxycycline and lymecycline). Antibiotics are the preferred treatment for managing *C. acnes* abundance and minimizing inflammation.⁹ Severe acne may also require isotretinoin

for long-term management.¹⁸ Severe nodulocystic acne may be hormone-related, particularly in adult female acne, and may require anti-androgens (eg, spironolactone and oral contraceptive pills), which can also help treat dysseborrhea.⁹ Epidermal barrier dysfunction, dyschromia, and scarring may be more pronounced in adult female acne, rendering the skin more susceptible to irritation from topical treatments.^{2,9,11} These challenges necessitate a comprehensive therapeutic approach incorporating a skincare regimen in the therapy for adult female acne to address these underlying factors effectively.^{15,16}

Widespread resistance to antibiotics used in acne treatment underscores the need for antibiotic stewardship, particularly since antibiotic treatment in dermatology is more common and often administered for longer durations than for other diseases.¹⁷ Notably, *C. acnes*' resistance to clindamycin, doxycycline, and minocycline is increasing, and it is strongly recommended that acne not be managed solely with antibiotic monotherapy.¹⁷ Antibiotic stewardship is essential to preserve the efficacy of

TABLE 2.

Prescription Acne Treatments		
Type	Formulation	Activity/Effect
Azelaic acid	10%, 15%, 20%	Dicarboxylic acid
Adapalene	0.1%, 0.3%	Topical retinoid
Doxycycline	75 mg, 150 mg	Oral antibiotic
Lymecycline	408 mg	Oral antibiotic
Tretinoin	0.025%, 0.05%, 0.1%	Topical retinoid
Tazarotene	0.05%, 0.1%	Topical retinoid
Trifarotene	0.005%	Topical retinoid
Isotretinoin	0.4 mg/kg daily	Oral retinoid
Spironolactone	200 mg	Anti-androgen

current and emerging antibiotics. The advisors recommend that antibiotic acne treatment be combined with topical BPO or retinoids to reduce the duration of antibiotic therapy and mitigate the risk of antibiotic resistance.

Recommendations for Acne Maintenance Treatment

Maintenance treatment with skincare, adjunctive to topical retinoids or antimicrobials, rather than continued antibiotic treatment, is preferred. Patients who have completed a course of isotretinoin or antibiotics may relapse and require maintenance.¹⁸ In addition to skincare, advisors recommend nonprescription maintenance options, including azelaic acid and salicylic acid, particularly for patients without access to dermatologists.⁹ Skincare monotherapy is also recommended as maintenance to mitigate the occurrence of new lesions following prescription therapy. Acne can cause scarring and dyschromia.^{1,4} Dyschromia is exacerbated by sun exposure.²⁷ The advisors recommend skincare, including sunscreen (factor 50+ during the day), and adjunctive to topical retinoid, BPO, or tranexamic acid to mitigate dyschromia. This is especially important for patients with skin of color (SOC) who have a higher dyschromia prevalence and for patients with lighter skin who present more skin sensitivity and erythema.^{2,14,15,22,27}

Role of Skincare in Adult Female Acne Management

Benefits of Skincare for Adult Female Acne

Epidermal barrier dysfunction, dyschromia, and scarring are significant concerns in adult female acne.¹¹ While improving acne severity, systemic and topical retinoids, antimicrobials, and antibiotics can cause epidermal barrier alteration.^{9,10,14,18,29,30} This leads to skin irritation, xerosis, retinoid-related dermatitis, xerophthalmia, and cheilitis.^{14,18,29,30} These treatments also increase transepidermal water loss, which is associated with acne severity.¹⁰ Evidence shows that acne-related epidermal barrier dysfunction frequently leads to irritation from acne treatments.^{7,11,31} Antibiotics can induce microbiome dysbiosis, a hallmark of acne pathogenesis.⁸ Consequently, systemic and topical acne treatments that exacerbate barrier dysfunction and dysbiosis can lead to flares if the epidermal barrier and the microbiome diversity are not restored.^{18,29} Moreover, exacerbating skin barrier dysfunction and irritation can significantly reduce treatment adherence.^{7,32}

Cleansers and emollients containing probiotics that promote microbiome homeostasis can help restore epidermal barrier function after treatment with retinoids, antimicrobials, and antibiotics.^{10,20,32} Prebiotic skincare can restore microbiome diversity, including *C. acnes* and *S. epidermidis* phylotypes.⁸ Evidence shows that skincare can relieve skin irritation and improve tolerance of long-term topical treatment regimens with retinoids, antimicrobials, and antibiotics.^{18,20,25,28,33,34} This is especially important in adult female acne, which is characterized by increased epidermal barrier dysfunction and

irritation.^{2,11} Adjuvant acne skincare minimizes adverse effects and potentially increases adherence to topical retinoids, BPO, and isotretinoin while maintaining treatment efficacy.^{7,32}

Skincare as Monotherapy for Mild Adult Female Acne

Skincare can improve adult female acne management outcomes and mitigate adverse effects when used as monotherapy for mild acne, adjunctive therapy for moderate-to-severe acne, and maintenance therapy.⁷ Evidence shows that skincare monotherapy for mild acne can reduce acne lesion counts, *C. acnes* colonization, and excess sebum while maintaining skin barrier function, improving acne severity and quality of life.^{7,35,36} A systematic review demonstrates that daily skincare with cleansers, emollients, and sunscreens can reduce the number of inflammatory and non-inflammatory acne lesions.¹⁹ This study emphasizes that the correct choice and skincare use are fundamental in acne management. A real-world study found that skincare monotherapy promotes a healthy skin barrier and improves acne management outcomes.²¹ A clinical study evaluating skincare monotherapy in patients with mild to moderately severe acne showed reductions in total lesion count, papules and pustules, *C. acnes* colonization, and excess sebum, as well as improved quality of life with active skincare treatment compared to vehicle treatment.³⁷ Skincare monotherapy may benefit patients with mild acne waiting to start or cannot tolerate prescription treatments. Based on these data and their clinical experience, the advisors recommend skincare as monotherapy for mild acne to reduce acne lesion counts and sebum production, maintain skin barrier function, and improve acne severity and QoL.

Skincare as Adjunctive Therapy for Moderate-to-Severe Adult Female Acne

Adjunctive skincare for moderate-to-severe acne can restore epidermal barrier function, reduce lesion count and skin irritation, and mitigate adverse events, leading to enhanced treatment efficacy, tolerance, and adherence.^{7,11,20,21} A systematic review found that adjunctive skincare improved acne treatment outcomes and mitigated adverse effects.²⁰ Lipid-free cleansers reduced skin irritation and maintained stratum corneum pH. A real-world study showed that adjunctive acne skincare promotes a healthy epidermal barrier, improving acne management outcomes.²¹ A clinical study in patients with moderate acne showed that adjunctive skincare restored acne-induced barrier disruption and reduced lesion count, irritation, and dryness compared to the control treatment.³³ Adjunctive skincare was well-tolerated, with no adverse events reported. Another clinical study in patients with mild to severe acne demonstrated maintained treatment efficacy and improved treatment tolerability and adherence with adjunctive skincare compared to acne treatment alone.³² Based on these data and clinical experience, the advisors recommend skincare as an adjunctive treatment for moderate-to-severe acne to maintain or enhance treatment efficacy, tolerability, and adherence.

Skincare as Maintenance Therapy

Skincare as maintenance therapy for mild to severe acne can restore epidermal barrier function, reduce lesion count, and prevent relapse.^{11,21,22} A clinical trial evaluated skincare maintenance treatment following adapalene/BPO therapy in patients with mild to moderate acne.²⁶ Skincare reduced inflammatory and noninflammatory lesion counts and prevented relapse compared to vehicle treatment, with no differences in skin dryness or irritation observed between treatment groups. Skincare maintenance therapy may serve as a bridging option for patients who have relapsed and are waiting to restart or who cannot tolerate prescription therapy. Based on these data and their clinical experience, the advisors recommend skincare as either mono- or adjunctive maintenance therapy for mild to severe acne to improve barrier function, reduce lesion count, and prevent relapse following prescription therapy.

Integrating Skincare Into Acne Treatment

Considerations for Adult Female Acne Moisturizers and Cleansers

Studies emphasize the importance of choosing the right acne skincare products that restore barrier functions, reduce and prevent lesion counts, and mitigate the adverse effects of prescription acne treatment.^{11,20,22} Effective emollients, typically containing ceramides, humectants, and oil absorbers, help restore skin barrier function and reduce lesion counts.^{11,20,22,36} Preferred skincare products should be effective in restoring the epidermal barrier, nonirritating, well-tolerated, anti-inflammatory, and cost-effective.

Epidermal barrier disruption is a major driver of acne severity and pathogenesis, particularly in adult female acne, and is often exacerbated or caused by acne prescription treatments.^{7,10,11,14,18,29,30} Non-comedogenic acne skincare should contain agents that restore epidermal barrier (ie, ceramides and niacinamide), control sebum production (eg, niacinamide and zinc), are anti-inflammatory (eg, zinc), keratolytic (eg, salicylic acid and alpha-hydroxy acid), comedolytic (eg, azelaic acid, glycolic acid, and salicylic acid), and humectant (eg, hyaluronic acid and glycerin).^{7,11,19-22,25,36} A clinical study evaluating niacinamide monotherapy in patients with moderate acne showed that niacinamide was as effective in reducing acne severity as antibiotic monotherapy, with greater effectiveness in oily skin types.³⁸ Another clinical trial evaluating maintenance skincare treatment containing salicylic acid following prescription treatment in patients with mild to moderate acne showed that skincare reduced lesion counts and prevented relapse compared to vehicle treatment.²⁶

Acne cleansers and emollients should have a near-physiological skin pH (4.0–6.0) and be soap-free, as an elevated skin pH increases inflammation and reduces epidermal barrier integrity.^{25,28,31} Broad-spectrum sunscreen (SPF 50+ for daytime

use) is essential in acne skincare because acne prescription therapies can cause dyschromia, thin the skin, and predispose to UV damage.²⁷ This is especially important for patients with lighter skin, who have a higher incidence of skin sensitivity and erythema, and patients with SOC, who have a higher prevalence of dyschromia.^{2,14,15,22,27}

Evidence shows that pre- and probiotics, such as *Vitreoscilla filiformis*, *Lactobacillus rhamnosus* lysate, and thermal spring water, can increase diversity and restore the skin microbiome in acne skin.^{8,10} A clinical study evaluating a prebiotic *L. rhamnosus* supplement in acne patients revealed normalized expression of genes involved in insulin signaling and improved acne severity with prebiotic treatment compared to placebo treatment.³⁹ Another clinical study evaluating a probiotic as monotherapy and adjunctive therapy in patients with mild to moderate acne showed a significant reduction in lesion count with adjunctive probiotic treatment compared to both probiotic and antibiotic monotherapies.⁴⁰ Acne during pregnancy and breastfeeding has treatment limitations. Appropriate skin care for pregnant women can mitigate acne manifestations.

Incorporating Skincare Into A Prescription Regimen for Female Acne

Acne substantially impacts quality of life, particularly in women, due to perceptions imposed by societal aesthetic ideology.^{3,4,6,7} However, while prescription acne treatments, such as azelaic acid, reduce acne and related dyschromia, they are less effective in addressing QoL-related symptoms, including self-perception.^{41,42} Evidence suggests that adjunctive acne skincare improves prescription treatment-induced barrier disruption and skin appearance, leading to an enhanced QoL.^{21,25,33}

The advisors agree that skincare recommendations, in addition to prescription therapies, are an important part of effective acne management to mitigate adverse effects and improve outcomes and patient QoL. The skincare regimen should be essential to acne prevention, treatment, and maintenance strategies. The advisors recommend that physicians prescribe skincare regimens in combination with prescription therapies, emphasizing skincare's importance in improving acne outcomes, treatment tolerability, and QoL.

Patient Counselling on Acne Skincare

Clinical practice guidelines for acne management emphasize the importance of shared decision-making to individualize acne care based on treatment benefits and risks, acne severity, extent, region, treatment costs, and patient preferences.⁹ However, a survey among adult females with acne revealed that many patients experience challenges in finding effective acne treatments and accessing care, highlighting the necessity of patient counselling in acne management.³ Furthermore, clinical practice guideline recommendations for skincare in

acne management are lacking.^{9,29} Recently updated clinical guidelines on acne management from the American Academy of Dermatology state that the available evidence is insufficient to develop recommendations on topical treatments for acne, including niacinamide, zinc, and tea tree oil.⁹

Acne clinical presentations differ according to patient profiles (eg, gender, age, and race), characteristics, preferences, and desired treatment outcomes, which may be influenced by cultural norms and practices.^{2,14-16,28} For example, while topical nicotinamide and clindamycin treatments show comparable overall reductions in acne severity, nicotinamide treatment was more effective in oily skin types, and clindamycin treatment was more effective in non-oily skin types.³⁸ This highlights the need for a personalized approach to acne management that considers patient characteristics and preferences.^{9,14-16,28} When selecting skincare, dermatologists should consider patient preferences and cultural practices.

Gender is an important factor in acne treatment selection, as female acne and transgender patients may require different treatment approaches.^{7,9} For example, severe comedonal or nodulocystic acne in adult female patients may require anti-androgens.⁹ Furthermore, acne is associated with gender-affirming hormone therapy and is common among transgender individuals.^{43,44} However, transgender patients with acne, particularly transgender women, often experience acne-related stigma and face barriers to treatment, including a lack of transgender-specific acne care education.⁴⁴

Financial considerations are also important, as acne skincare products vary in cost.⁹ Dermatologists can help alleviate the costs of trialing different skincare products by providing samples or a shortlist of preferred skincare options.

Limitations

The advisors aim to provide insight into acne treatment strategies specifically for patients in Nordic European countries, which may limit the generalizability of the recommendations. The evidence on skincare as monotherapy or adjunctive to prescription acne therapy is heterogeneous, making it difficult to develop recommendations on specific skincare ingredients and products.

CONCLUSION

The NECASA II algorithm offers guidance on treatment and skincare selection based on acne severity, patient characteristics, and preferences. The advisors strongly support skincare integration in acne management as monotherapy for mild acne, adjunctive therapy for moderate-to-severe acne, and maintenance therapy to prevent relapse. Prioritizing formulations that restore the epidermal barrier, control sebum production, and mitigate inflammation is essential, alongside

the judicious use of prescription and nonprescription treatments. By integrating prescription treatments with evidence-based skincare recommendations, clinicians can mitigate adverse effects and enhance treatment tolerability and adherence. Personalized treatment regimens, including patient education and shared decision-making, will improve clinical outcomes and overall patient well-being in managing adult female acne.

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