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MODERN METHODS OF TREATING ATOPIC DERMATITIS IN CHILDREN

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Annotation: Atopic dermatitis (AD) is a chronic, relapsing, inflammatory skin disorder that commonly affects children and is characterized by intense pruritus, dry skin, and eczematous lesions. Its prevalence has significantly increased in recent decades, especially in urban and industrialized areas, making it one of the most common dermatological conditions in pediatric populations. The pathogenesis of atopic dermatitis is multifactorial and includes genetic predisposition, skin barrier dysfunction, immune system dysregulation, and environmental factors. Recent studies emphasize the importance of early diagnosis and individualized treatment approaches. Modern methods of treatment involve a combination of basic skin care (emollients and moisturizers), topical anti-inflammatory therapies (mainly corticosteroids and calcineurin inhibitors), and advanced systemic therapies in severe or refractory cases. Among innovative approaches, the use of biologic agents such as dupilumab—a monoclonal antibody targeting interleukin-4 and interleukin-13 signaling—has shown significant efficacy and safety in children with moderate-to-severe atopic dermatitis. Moreover, attention is increasingly given to non-pharmacological management including allergen avoidance, dietary adjustments, psychological support, and patient education. This article provides an overview of current diagnostic criteria and evidence-based treatment strategies, highlighting the role of emerging therapies in improving the quality of life in pediatric patients. Emphasis is also placed on the importance of a multidisciplinary approach and long-term disease monitoring.

Keywords: Atopic dermatitis, children, pediatric dermatology, chronic skin inflammation, eczema, skin barrier dysfunction, immune dysregulation, genetic predisposition, environmental triggers, pruritus, moisturizers, emollient therapy, topical corticosteroids, calcineurin inhibitors, systemic treatment, biologic therapy, dupilumab, interleukin-4, interleukin-13, allergen avoidance, dietary interventions, patient education, psychological support, quality of life, multidisciplinary approach, disease management, flare prevention, immunomodulators, innovative treatment, non-pharmacologic therapy.

Introduction.

Atopic dermatitis (AD), also known as atopic eczema, is one of the most prevalent chronic inflammatory skin diseases in children, affecting up to 20% of the pediatric population worldwide. The condition is characterized by recurrent episodes of eczematous lesions, intense itching (pruritus), xerosis (dry skin), and a significant impact on the quality of life of both the child and their family. Although AD often begins in infancy or early childhood, it can persist into adolescence and adulthood in many cases. The pathogenesis of atopic dermatitis is complex and multifactorial, involving an interplay between genetic, immunological, and environmental factors. Mutations in the filaggrin gene, which plays a crucial role in skin barrier function, have been strongly associated with the development of

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AD. Skin barrier dysfunction facilitates allergen penetration and increases susceptibility to microbial colonization, especially by Staphylococcus aureus, further exacerbating inflammation. Additionally, dysregulation of the immune system, particularly the dominance of the T-helper 2 (Th2) immune response, contributes to chronic inflammation and hypersensitivity reactions. Environmental influences such as climate, air pollution, dietary habits, hygiene practices, and exposure to allergens also play a significant role in the onset and progression of AD. Psychosocial stress and sleep disturbances further worsen symptoms, creating a vicious cycle of itching and scratching, known as the "itch-scratch" cycle. The management of atopic dermatitis has traditionally relied on symptomatic treatment, including the use of emollients to restore skin barrier function and topical corticosteroids to reduce inflammation. However, recent advances in the understanding of the disease's molecular mechanisms have led to the development of targeted therapies, including non-steroidal topical agents and biologic drugs such as dupilumab, which block specific cytokines involved in the inflammatory cascade. In pediatric patients, effective treatment of AD requires a holistic and individualized approach that considers disease severity, comorbid allergic conditions (such as asthma and allergic rhinitis), and psychosocial impact. Education of parents and caregivers, regular skin care routines, and early intervention are critical for long-term disease control and prevention of complications. This article aims to explore the modern therapeutic strategies for atopic dermatitis in children, highlighting recent innovations, clinical efficacy, safety profiles, and practical considerations in pediatric dermatological practice.

Main Body.

1. Pathophysiology and Etiology of Atopic Dermatitis. Atopic dermatitis (AD) is a complex, chronic, and relapsing skin disorder that involves both genetic and environmental factors. The cornerstone of its pathogenesis is a dysfunctional skin barrier and a dysregulated immune response. Filaggrin, a protein essential for maintaining skin barrier integrity, is often deficient in AD patients due to mutations in the FLG gene. This impairment leads to increased transepidermal water loss (TEWL), enabling allergens, irritants, and microbes to penetrate the skin more easily, initiating an inflammatory response. Immunologically, AD is characterized by a Th2-dominant immune profile, particularly in the acute phase. Cytokines such as interleukin (IL)-4, IL-5, and IL-13 promote IgE production, eosinophilia, and further compromise of the skin barrier. Chronic lesions involve a mix of Th1 and Th17 responses, adding complexity to the disease. Additionally, microbial colonization, especially by Staphylococcus aureus, is prevalent in AD patients and exacerbates inflammation through the release of toxins that act as superantigens. Environmental triggers such as dust mites, pollen, pet dander, certain foods, and weather changes can initiate or worsen flares. Psychosocial factors including stress, anxiety, and sleep disruption also contribute significantly to disease severity in children.

2. Diagnosis and Severity Assessment. Clinical diagnosis of AD is based on established criteria such as the Hanifin and Rajka criteria or the UK Working Party's diagnostic criteria. Key features include pruritus, typical morphology and distribution of lesions (e.g., cheeks, scalp, and extensor surfaces in infants; flexural areas in older children), and chronic or relapsing course. Laboratory findings such as elevated serum IgE and eosinophil counts may support diagnosis but are not specific. Severity of AD can be graded using tools like SCORAD (Scoring Atopic Dermatitis), EASI (Eczema Area and Severity Index), and

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POEM (Patient-Oriented Eczema Measure), which help guide treatment plans and monitor response to therapy.

3. Basic Management: Skin Barrier Repair. The foundation of all AD treatment strategies is restoring and maintaining the skin barrier. Daily use of emollients and moisturizers helps retain skin hydration, reduce TEWL, and improve the efficacy of anti-inflammatory treatments. Products containing ceramides, glycerin, or urea are particularly effective. Bathing should be limited to lukewarm water with mild, fragrance-free cleansers, followed by immediate application of moisturizers. Education of caregivers about skin care routines is essential for long-term adherence and success.

4. Anti-inflammatory Therapy. Topical corticosteroids (TCS) remain the first-line treatment for controlling flares. Potency should be selected based on patient age, site of involvement, and severity. Low-potency TCS are preferred for the face and intertriginous areas in children, while medium-potency agents may be used on limbs and trunk. Topical calcineurin inhibitors (TCIs), such as tacrolimus and pimecrolimus, are steroid-sparing agents recommended for sensitive areas and long-term maintenance therapy. They are particularly useful in patients with frequent relapses and in those with corticosteroid phobia. Phosphodiesterase-4 (PDE4) inhibitors like crisaborole offer another non-steroidal option with anti-inflammatory effects and minimal side effects.

5. Systemic Therapies for Moderate-to-Severe Cases. In cases where topical therapy fails to control symptoms or in severe, widespread disease, systemic treatments may be necessary. Traditional systemic immunosuppressants include cyclosporine, methotrexate, azathioprine, and mycophenolate mofetil. These drugs are effective but carry risks of systemic side effects and require close monitoring. The most significant advancement in AD management has been the development of biologic therapies. Dupilumab, a fully human monoclonal antibody targeting the IL-4 receptor alpha (blocking IL-4 and IL-13 pathways), has demonstrated substantial improvements in disease severity, pruritus, and quality of life in both adults and children with moderate-to-severe AD. It is currently approved for children aged 6 months and older in many countries. Ongoing research into other biologics and Janus kinase (JAK) inhibitors such as abrocitinib and upadacitinib also shows promise, offering more options for children with difficult-to-treat AD.

6. Non-pharmacological and Adjunctive Therapies. Adjunctive treatments play a vital role in comprehensive AD management. Allergen identification and avoidance can be helpful, especially in cases with proven food or aeroallergen sensitization. However, routine food elimination diets are not recommended without diagnostic confirmation, as they can cause nutritional deficiencies. Probiotics and prebiotics are being studied for their role in immune modulation and maintaining gut-skin axis balance. Phototherapy (narrowband UVB) may be beneficial in older children with extensive disease unresponsive to topicals. Psychological support is crucial, particularly for children with severe AD and their families, due to the emotional and social burden of the disease. Sleep disturbances caused by itching are common and should be addressed. Patient and parent education programs that teach proper skin care, trigger avoidance, and flare management have shown to reduce disease severity and healthcare use.

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7. Emerging Trends and Personalized Medicine. Recent trends in AD treatment focus on precision medicine—tailoring therapy to individual patient characteristics, including genetic, immunologic, and microbiome profiles. Advances in omics technologies and biomarkers may help predict treatment response and guide personalized treatment plans in the near future. Furthermore, digital health tools and mobile apps are being integrated to improve treatment adherence, disease tracking, and communication between caregivers and healthcare providers.

Conclusion:

Atopic dermatitis remains one of the most prevalent and burdensome chronic skin conditions in the pediatric population. Its multifactorial pathogenesis involving genetic mutations, immune dysregulation, environmental influences, and skin barrier dysfunction demands a comprehensive and individualized approach to diagnosis and treatment. Over the past decade, significant progress has been made in understanding the underlying mechanisms of the disease, leading to the development of more effective and targeted therapies. Management of atopic dermatitis in children must begin with consistent skin care routines, including the liberal use of emollients and appropriate bathing practices to restore and maintain skin barrier function. Topical corticosteroids and calcineurin inhibitors continue to play a central role in controlling inflammation during disease flares. In moderate to severe cases, systemic therapies—especially biologics such as dupilumab—have revolutionized treatment options by offering targeted, well-tolerated, and effective long-term control. Non-pharmacological strategies, including allergen avoidance, nutritional support, psychological care, and patient education, are essential in improving disease outcomes and quality of life. An interdisciplinary approach that includes dermatologists, pediatricians, allergists, and mental health professionals is ideal for managing complex cases. The future of pediatric atopic dermatitis care lies in personalized medicine. With ongoing advancements in genomics, immunology, and microbiome research, the potential for tailored therapies is promising. Emerging digital health tools and telemedicine may also enhance disease monitoring and treatment adherence in young patients. Ultimately, early diagnosis, education, and an integrated treatment plan tailored to each child's specific needs are crucial in minimizing disease severity, preventing complications, and ensuring a better quality of life for both patients and their families.

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