

The Evolution of Acne Management: From Historical Practice to Evidence-Based Care

MacArthur, M.^{1,2}, Skuridina, N.^{1,2}, Martin, A.^{1,2}, Derohan, A.^{1,2}, Fazeli, H.^{1,2}, Sharobim, A.^{1,2}, Qureshi, K.^{1,2}, O'Brien, A.^{1,2}, McQuillan, C.^{1,2}, Lim, J.^{1,2}, Ibrahimi, N.^{1,2}

¹ School of Medicine, University College Cork, Cork, Ireland

² Dermatology Society, University College Cork, Cork, Ireland

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Abstract

Acne vulgaris is a chronic inflammatory disorder with significant psychosocial impact. Its prevalence and prolonged disease course make it an ideal condition for examining the historical evolution of dermatology from empiricism to evidence-based, mechanism-driven care. Historical explanations of acne were shaped by prevailing medical theories of their time, including humoral concepts that attributed cutaneous disease to internal imbalance, diet, hygiene, and environmental impurities. The mid-twentieth century was marked by advances in microbiology and pharmacology, facilitating the development of targeted therapies, including antibiotics, retinoids, and isotretinoin, thereby transforming acne treatment into pathophysiology-driven care. By the late twentieth century, the role of hormonal regulation became increasingly apparent, with androgens being recognised as key drivers of acne pathogenesis. Concurrently, growing recognition of the psychological burden of acne contributed to the emergence of psychodermatology. Modern acne management is characterised by an evidence-based, multimodal approach that reflects the disease's multifactorial pathogenesis, with combination therapy now considered standard of care. Emerging therapies and digital innovations highlight an ongoing shift towards precision and sustainability.

Introduction

Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous unit that affects approximately 85% of adolescents and a substantial proportion of adults worldwide [1,2]. While often dismissed as a benign condition, acne is associated with significant psychosocial morbidity, including reduced quality of life, anxiety, depression, and social impairment [3].

Its prevalence, visible nature, and prolonged disease course make acne an ideal condition for examining the historical evolution of dermatology from empiricism to evidence-based, mechanism-driven care.

Early Understandings of Acne

Acneiform disorders have been recognised for centuries, with historical descriptions appearing in ancient medical texts from Egypt, Greece, and Rome. Treatments from antiquity included sulphur, honey, resins, and mineral-based preparations, reflecting therapeutic strategies grounded in observation rather than mechanistic understandings [4].

During the nineteenth century, acne became more clearly defined within emerging dermatological literature. However, disease classification remained inconsistent, with acne vulgaris and rosacea often conflated. Contemporary theories attribute acne to constitutional factors, dietary excess, gastrointestinal dysfunction, or inadequate hygiene [5].

A major conceptual advance occurred with growing recognition of sebaceous gland physiology and follicular occlusion as central to lesion development [6]. This marked an important transition from symptom-based treatment towards biologically informed disease models, paving the way for the modern understanding of acne as a multifactorial disease and setting the stage for targeted therapeutic innovation.

Targeted Therapeutic Developments

The mid-twentieth century marked a pivotal shift in acne management as advances in microbiology and pharmacology transformed treatment from empiricism to mechanism-based intervention.

The identification of Cutibacterium acnes (C. acnes) as a key contributor to follicular inflammation catalysed the widespread adoption of topical and systemic antibiotics, including tetracyclines and macrolides. These agents demonstrated significant clinical efficacy through combined antimicrobial and anti-inflammatory effects, allowing acne to be reliably suppressed rather than merely managed symptomatically [7].

However, the success of antibiotic therapy was accompanied by unintended consequences. Prolonged and often indiscriminate use led to rising antimicrobial resistance in C. acnes and commensal flora, diminishing long-term effectiveness and raising broader public health concerns [8]. These limitations highlighted the need for non-antibiotic, disease-modifying strategies.

A parallel breakthrough emerged with the development of topical retinoids. By targeting abnormal follicular keratinisation and promoting comedolysis, agents such as tretinoin addressed a core pathogenic process rather than downstream inflammatory sequelae [9]. Retinoids also enhanced the penetration and efficacy of adjunctive therapies, establishing their role as foundational treatments in acne management.

The introduction of oral isotretinoin in the late 1970s represented a further paradigm shift. By reducing sebaceous gland size, suppressing sebum production, normalising follicular keratinisation, and exerting anti-inflammatory effects, isotretinoin became the first therapy capable of inducing prolonged remission in severe acne. However, relapse may still occur in a subset of patients [10].

Table 1 Historical timeline of major developments in acne treatment (adapted from [5]).

Era	Key Development	Example Treatment
Pre-1900	Empirical	Sulfur, mercury
1950s-60s	Antibiotics	Tetracyclines
1970s	Retinoids	Tretinoin
Late 1970s	Systemic	Severe acne therapy
1990s-2000s	Hormonal therapy	COCPs, spironolactone
Modern era	Multimodal therapy	Retinoid + benzoyl peroxide +

Its use, however, was accompanied by profound ethical and regulatory considerations, particularly regarding teratogenicity, necessitating strict prescribing controls and comprehensive informed consent frameworks [11]. Collectively, antibiotics, retinoids, and isotretinoin exemplify the transition from symptomatic treatment to targeted, pathophysiology-driven care. However, despite their effectiveness, these therapies are not without limitations.

Long-term antibiotic use has contributed to increasing antimicrobial resistance among *Cutibacterium acnes* and other commensal organisms, prompting renewed emphasis on antibiotic stewardship. Although oral isotretinoin can induce prolonged remission in 80% of cases, relapse occurs in 20% of patients with roughly 8% requiring a secondary course of treatment [12]. Additionally, the effectiveness of topical regimens is often limited by poor adherence, as irritation, complex routines, and delayed onset of visible improvement can reduce patient compliance [13].

Hormonal, Psychosocial, & Multimodal Care

By the late twentieth century, the understanding of acne pathogenesis expanded, and the role of hormonal regulation became increasingly apparent. Androgens were recognised as key drivers of sebaceous gland growth and sebum production in both males and females. While androgenic influence diminishes in adult males, it remains clinically significant in adult females, highlighting a greater hormonal contribution to acne pathogenesis in women. Conversely, estrogens were shown to suppress sebaceous gland activity, likely by inhibiting androgen secretion [14].

These insights facilitated the development of hormonal therapies, including combined oral contraceptives and anti-androgen agents. Initially reserved for patients with overt hyperandrogenism, such therapies are now recognised as effective options for women with severe acne or disease resistant to conventional treatment [15]. This shift reflects a broader movement towards individualised care that accounts for biological variability rather than a one-size-fits-all approach.

Concurrently, increasing recognition of the psychological burden of acne contributed to the emergence of psychodermatology as an essential consideration in management. Acne is now understood not only as a cutaneous disorder, but as a condition with significant emotional and psychosocial dimensions, reinforcing the need for holistic, patient-centred care [15].

The psychosocial burden of acne is frequently quantified in research using validated instruments such as the Dermatology Life Quality Index (DLQI), which assesses the impact of skin disease on patients' daily functioning and wellbeing [16]. Its widespread adoption has established it as a benchmark instrument for evaluating dermatology-specific quality-of-life outcomes [17].

Contemporary Acne Management

Modern acne management is characterised by an evidence-based, multimodal approach that reflects the disease's multifactorial pathogenesis. Combination therapy is now considered the standard of care, with multiple agents targeting distinct pathogenic pathways (such as sebum production, comedogenesis, and inflammation) demonstrating superior efficacy compared to monotherapy [18,19]. For example, patients with moderate inflammatory acne are commonly treated with a combination of a topical retinoid to address comedogenesis, benzoyl peroxide to reduce bacterial proliferation, and a short course of oral antibiotics to control inflammation.

Despite the concerns regarding antimicrobial resistance, antibiotics remain an essential component of treatment for moderate to severe inflammatory acne. However, current guidelines prompted a more judicious approach: limiting antibiotic use to defined courses, avoiding monotherapy, and regularly reviewing the need for continuation [20]. Non-antibiotic agents, including benzoyl peroxide, azelaic acid, and topical retinoids, play a central role in the management of mild to moderate acne and in long-term maintenance therapy. These treatments offer anti-inflammatory, antimicrobial, and anti-comedogenic benefits without contributing to resistance [21,22].

Ultimately, contemporary acne care requires balancing clinical efficacy with safety, accessibility, and patient adherence. Individualised, guideline-based management is essential for achieving sustained disease control while minimising unnecessary or prolonged medication exposure [13].

Conclusion & Future Directions

Viewed in historical context, acne management has progressed from empirical and often harmful treatments to targeted, pathophysiology-driven care. Advances in microbiology, pharmacology, and hormonal understanding enabled the development of disease-modifying therapies, while contemporary management emphasises multimodal, evidence-based approaches, antimicrobial stewardship, and individualisation, reflecting the broader evolution of modern dermatological practice.

The future of acne management is increasingly oriented towards precision and sustainability. Emerging strategies include postbiotics, topical probiotics, bacteriophage-based therapies, and novel anti-inflammatory agents [23,24]. While these approaches show promise in early experimental and clinical studies, most remain investigational and are not yet part of routine clinical practice. Digital innovation is also beginning to influence acne care, with artificial intelligence being explored for disease severity assessment, treatment monitoring, and clinical decision support [25]. Although many of these approaches remain investigational, they exemplify how scientific innovation continues to reshape the future of dermatological care.

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