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Short Communication

Innovative Approaches in Psoriasis Treatment: The Role of Biologics and Nanotechnology

Nathaniel Brooks*

Department of Dermatology, University of Chicago, Chicago, United States of America

DESCRIPTION

Psoriasis is a complex chronic inflammatory skin disorder that manifests in well-defined, erythematous plaques covered with silvery scales. It affects approximately 2%-3% of the global population, significantly impairing the quality of life of those afflicted. Understanding the pathogenesis of psoriasis is important for developing effective therapies, as the disease is driven by a complex exchange between genetic, immune and environmental factors [1]. Psoriasis involves dysregulated immune responses, where the overactivation of T-helper (Th) cells, especially Th17 cells, factors inflammation [2]. These immune cells, along with the production of inflammatory cytokines such as interleukin (IL)-17, IL-23 and Tumor Necrosis Factor (TNF)-alpha, lead to keratinocyte proliferation and the formation of psoriatic plaques [3]. Additionally, environmental factors such as infections, stress and trauma, combined with genetic predisposition, contribute to the exacerbation of the disease.

Recent advancements in psoriasis treatment have significantly shifted from traditional therapies to more targeted, biologic approaches. Historically, treatments like topical corticosteroids, phototherapy and systemic immunosuppressants were the mainstay for managing psoriasis [4]. However, these therapies often come with side effects and limited long-term efficacy. Biologic factors which target specific immune pathways involved in psoriasis have emerged as innovative treatments. IL-17 inhibitors, IL-23 inhibitors and TNF-alpha inhibitors have shown remarkable success in patients with moderate-to-severe psoriasis, providing long-term disease control and improvement in patient quality of life. Despite their efficacy, biologics are often expensive and are associated with risks such as infections, making them less accessible for all patients [5].

This limitation has prompted a growing interest in novel therapeutic strategies, particularly those involving nano-technology. Nanoparticles provide the potential to revolutionize the treatment environment for psoriasis by improving the delivery and efficacy of existing drugs while minimizing side effects [6]. Nano-formulations enhance the bioavailability and stability of active pharmaceutical ingredients, allowing for controlled and targeted drug delivery to affected skin layers [7]. This targeted approach not only improves drug penetration but also limits systemic side effects, a common issue with traditional treatments. For example, corticosteroids, which are commonly used in topical treatments for psoriasis, can be formulated in nanoparticles for slow, sustained release, thereby improving their therapeutic outcomes and reducing the risk of side effects such as skin thinning [8].

Nano-therapy extends beyond drug delivery systems and includes the development of photothermal and photodynamic therapies. Gold nanoparticles, for example, have been studied for their ability to absorb light and convert it into heat, thereby selectively targeting psoriatic lesions with minimal impact on surrounding tissues [9]. When exposed to specific wavelengths of light, these nanoparticles can induce localized heat, potentially providing a non-invasive option for treating psoriasis. Similarly, photodynamic therapy, where nanoparticles are loaded with photosensitizing agents, has been explained as a means to induce cell death in psoriatic skin lesions through light activation. These innovative approaches provide precise treatment options, which could significantly reduce the need for systemic interventions and their associated side effects [10].

Another potential application of nano-technology in psoriasis treatment is the development of lipid-based nanoparticles, such as liposomes, which can formulated both hydrophilic and lipophilic drugs. Liposomes can enhance the stability of active compounds like vitamin D analogs, which play an essential role in regulating skin cell proliferation and differentiation. Furthermore, these lipid-based nanoparticles can be customized to improve skin penetration, ensuring that therapeutic agents are delivered precisely to the dermal layers affected by psoriasis. This strategy could result in more efficient and localized treatment, reducing the need for systemic administration and lowering the risk of adverse reactions.

Correspondence to: Nathaniel Brooks, Department of Dermatology, University of Chicago, Chicago, United States of America, E-mail: nathaniel.brooks@maplewood.edu

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In conclusion, psoriasis remains a complex and challenging disease to manage, but advances in our understanding of its pathogenesis and the development of targeted therapies have significantly improved treatment outcomes. Biologic agents have become a cornerstone for managing moderate-to-severe psoriasis, providing patients long-term control of their disease. However, the high cost and potential side effects of biologics highlight the need for alternative approaches. Nano-technological-based therapies, such as drug-delivering nanoparticles and photodynamic treatments, provide innovative solutions for enhancing the efficacy of psoriasis treatments while minimizing side effects.

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