

Transdermal Drug Delivery: Benefits and Challenges

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Editorial

Being the largest and most easily accessible organ of human body, the skin provides a painless and patient-friendly interface for systemic drug administration [1]. The creation of transdermal delivery systems is one of the most important innovations enabling the successful implementation of many of novel as well as conventional drugs [2]. Problems associated with the barrier properties of the skin, reducing skin irritation rates and improving the aesthetics associated with patch systems have been the focus of many researches [3].

Transdermal delivery is well known to minimize and avoid many limitations associated with oral and parenteral administration of drugs including [4-6]: improved efficacy-to-tolerability ratio by regulating serum drug levels; controlled and extended release of drugs; avoid gastrointestinal and hepatic pre-systemic metabolism; non-invasive techniques in addition to possible site-rotation; ability to limit diversion and abuse of opioid medications. However, the success of systemic drug delivered through the skin is opposed by the high impermeability and complexity of skin structure.

The skin is composed of two main layers [7]: (a) the dermis which contains a variety of cell types, nerves, blood vessels and lymphatics embedded in a dense network of connective tissue, and (b) the epidermis, which is the outer layer, is composed of layers of stratified keratinocytes bathed in a protein-rich envelope with an outer lipid envelope. The horny skin layer, or the stratum corneum, is the outermost 5–20 µm of the skin. It represents the main physical barrier of the skin and is mostly the rate limiting step for transdermal drug permeation.

The factors influencing transdermal absorption are therefore very complex in nature and act in a mutually dependent manner, hence, attainment of a therapeutically effective drug level is difficult without enhancing skin permeation [8].

Many techniques have been exploited to breach the skin barrier [4], these involve chemical (passive) and physical (active) methods, based on two strategies or the synergistic mixtures of both mechanisms: increasing skin permeability and providing driving force acting on the drug [9]. Various methods of transdermal penetration enhancement have been widely discussed in literature [3, 4, 7, 9-16]; these can be summarized briefly as follows: (a) Passive approaches are ranging from chemical enhancers which either increase the diffusivity across the skin or increase the drug solubility in the skin to newer innovative approaches which involve the extension of this concept to the design of novel formulations like microemulsions, vesicular systems, nanoparticles and inclusion complexes; (b) active approaches involve the use of external energy to act as a driving force and/or act to reduce the barrier nature of the stratum corneum in order to enhance permeation of drug molecules into the skin, these techniques involve:

the iontophoresis, sonophoresis, electroporation, microneedles, magnetophoresis and laser radiation.

Nowadays many TDDS products, having bioactive under categories that include hypertension, angina, motion sickness, female menopause, male hypogonadism, pain control, nicotine dependence, and recently, contraception, urinary incontinence, parkinson's disease, attention deficit and hyperactivity disorder and female sexual dysfunction, are approved by FDA. Much research is still in progress for the development and scale up of new transdermal products.

Although these products are gaining worldwide popularity and although transdermal drug delivery is providing good opportunities for innovative and challenging research, the benefits for such route of administration still remains controversial.

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