



Transdermal Drug Delivery System (TDDS): A Review

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Abstract:-

Overview the Transdermal drug delivery system are technologies that allow drugs to be absorbed through the skin. This system has many advantages over conventional routes of administration such as intravenous or oral administration for easy to administer systemic and local drug delivery. Transdermal drug delivery system could be applicable in not only pharmaceutical but also in skin care industry, including cosmetics. In this review, we describe the Transdermal drug system methods, along with a critical discussion of the specific advantages and disadvantages. A Transdermal drug delivery system is a drug administered topically in the form of a patch that delivers the drug for systemic effect at a predetermined and controlled rate.

Keywords :- Transdermal delivery, Patches, First -generation TDDS, Second –generation TDDS, Drug, Drug-in- Adhesive, micro needles

INTRODUCTION:-

Transdermal drug delivery system defined as self contained , self discrete dosage forms ,which applied to the intact skin deliver the drug at a controlled rate to the systemic circulation . The simple patch that you stick like an adhesive bandage , which utilize passive diffusion of drugs across the skin as the delivery mechanism. The most therapeutic peptides and some proteins are not delivered by the oral route , because of rapid degradation in the stomach. The conventional routes of medication delivery have many inherent limitation which could potentially be overcome by advanced drug delivery methodology such as Transdermal drug delivery system.

Skin Anatomy :-



The skin is the largest organ of the body , with a total area of about 20 square feet .The skin protects us from microbes and the elements , help regulate body temperature , and permits the sensations of touch , heat, and cold.

- The epidermis, the outermost layer of skin, provides a waterproof barrier and creates our skin tone.
- The dermis, beneath the epidermis, contains tough connective tissue, hair follicles, and sweat glands.
- The deeper subcutaneous tissue (hypodermis) is made of fat and connective tissue

The drug delivery routes across human skin, a molecule reaches intact skin by three pathway

- 1) Sweat duct
- 2) Hair follicles
- 3) Sebaceous gland

AIM OF TRANSDERMAL DRUG DELIVERY SYSTEM :-

For transdermal products, the goal of dose design is to minimize drug retention and metabolism within the skin while maximizing flux through the skin into the systemic circulation.¹

*Advantages of Transdermal Drug Delivery*² :-

- 1) Avoidance of peak and trough blood levels associated with conventional oral dosing.
- 2) Avoidance of first-pass metabolism in the gastrointestinal tract.
- 3) Reduced inter- and intra-patient absorption variability.
- 4) Prolonged duration of action and reduced dosing frequency after administration of the dosage form.
- 5) Improved compliance, especially drugs with short half-lives.
- 6) Concentration dependent selectivity of drug action.
- 7) Drowsiness, confusion, blurred vision, relatively short duration of action.

Disadvantages of Transdermal Drug Delivery^{2, 15} :-

1. High cost
2. local irritation
3. Low permeability limits
4. No ionic drug delivery
5. Low drug level in blood plasma
6. No rapid drug release
7. Molecular size restriction
8. Variation in barrier function

Approaches used in development of TDDS^{3,4,5} :-

Several techniques have been successfully developed to provide rate control of drug release and percutaneous penetration. These technologies can be grouped into four approaches:

1. Membrane Permeation – Control System
2. Adhesive Dispersion – Type System
3. Matrix diffusion - control system.
4. Micro reservoir type or Micro Sealed Dissolution control system.

1]. Membrane Permeability Control System:-

In this type of system, the drug reservoir is encapsulated in a flat chamber formed from a drug-impermeable metal-plastic laminate and a rate-limiting Polymer membrane.

2] Adhesive Dispersed System:-

This is the simplified form of the Membrane Permeation Control System. For example, drug reservoirs are formulated by dispersing drug directly into the adhesive polymer.

3] Controlled Matrix Diffusion Systems:-

In this approach drug reservoirs are formed by uniformly dispersing drug solids in a hydrophilic or lipophilic polymer matrix. The resulting medicated polymer is formed into medicated discs of defined surface area and controlled thickness.

4] Micro reservoir Type or Micro seal Resolution:-

The Micro reservoir Type drug delivery system can be viewed as a combination of a reservoir and a matrix diffusion drug delivery system. Next prepare this Mal therapeutic transfer system by placing the medicated disc in the center and surrounding it with a border of adhesive

Advances in transdermal delivery system^{6,7,8,9} :-

1] Patch technology for protein delivery

2] Nanotechnology gaining hold

3] Biodegradable micro needles

4] Hollow micro needles

Patch technology for protein delivery :-

Transdermal delivery of large proteins method, transpharma leverages its proprietary His printed patch technology for transdermal delivery of proteins and complements His technology for transdermal delivery.

The highly water-soluble protein is hypothesized to be dissolved by the interstitial fluid secreted from the skin through the HF micro channels to form a highly concentrated protein solution in situ. The dissolved molecules are then delivered to viable tissue in the skin via RF Micro channels, where diffuses down a steep concentration gradient.

Nanotechnology gaining hold :-

This technology combines the advantages of a needle and a transdermal patch. The device is a strip of Dime polymer containing hundreds of hollow microneedles 100 to 1,000 microns in length. Penetrates the top layer of the skin and allows the drug to easily pass through.

Biodegradable micro needles :-

Involves encapsulation of the drug within the biodegradable, polymeric microneedles, which is then inserted into the skin.

Hollow micro needle :-

Involves injecting drug through a hollow-bore needle.

Transdermal drug delivery systems generations^{10,11,12,13,14} :-

1] First generation TDDS

2] Second generation TDDS

3] Third generation TDDS

First generation transdermal delivery systems are used in most of the transdermal patches in clinical use to date. Significant advances in patch technology and public acceptance have recently led to the emergence of the first generation of transdermal patches.

In first generation, traditional patches such as clonidine or estrogen

Second generation transdermal delivery systems recognize the need for improved skin permeability to extend the utility of transdermal therapeutics. An ideal enhancer would-

- provide an added driving force for transport into the skin and avoid injury to deeper, living tissues

- increase skin permeability by reversibly disrupting stratum structure

In second generation, the patch with enhancement to improve drug delivery

Third generation TDDS, use novel technology to increase the scope of molecules that can be delivered through the skin

Types of transdermal patches^{16,17,18,19,20} :-

1) Single layer Drug in-Adhesive :-

In this type of patch, the adhesive layer not only adheres the different layers to the skin along with his entire system, but is also involved in the release of the drug. Surrounding the adhesive layer is a temporary liner and backing.

2) Multilayer Drug-in- Adhesive :-

However, multilayer systems differ in that they add another layer of drag-in adhesive, usually separated by a membrane (but not in all cases).

3) Reservoir :-

Single and Multilayer Systems In contrast to drug adhesives, the transdermal reservoir system has a separate drug layer.

4) Matrix :-

The matrix system has a drug layer of semi-solid matrix containing a drug solution or suspension. The adhesive layer of this patch surrounds the drug layer partially overlying the drug layer.

5) Vapour Patch:-

In this type of patch, the adhesive layer not only adheres the various layers together, but also serves to release vapor. The steam patch is new to the market, which releases essential oils for up to hours.

CONCLUSION:-

The Transdermal drug delivery system represent a new drug delivery system, the transdermal drug delivery system offers an attractive opportunity to address the poor bioavailability of oral drugs. It is beneficial innovation for drug delivery, particularly in patient who cannot swallow the medication. The Transdermal dosage forms may offers physicians an opportunity to offer more treatment option to optimize patient care. The drugs generally reliably and safely delivered by transdermal drug delivery system and are safe and stable against biochemical modification until they reach target tissues.

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