



A BRIEF REVIEW ON: TRANSDERMAL DRUG DELIVERY SYSTEM

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Abstract: Approximately 74 % of medicines currently administered orally and are found to be ineffective. The strategy of Transdermal Drug Delivery has full-grown in quality as a viable alternative to systemic drug administration. Transdermal Drug Delivery System technologies have currently been created and are thought to be helpful within the rate-controlled delivery of that are difficult to administer. The transdermal delivery has an advantage over injectable and oral delivery as a result of it improves patient compliance and avoids first-pass metabolism. Transdermal administration of drug could be a another technique of delivery that may significantly transport larger molecules in strong amounts, overcoming problems with oral administration like restricted bioavailability due to first-pass metabolism, which may result in fast blood level increase (both high and low). Transdermal medicines have the potential to boost the efficiency and safety of prescribed drugs. The patch delivers medication to the patient during a controlled manner, typically, a porous membrane covering a drug reservoir or body heat melting thin layers of medication incorporated within the adhesive are used, that is an advantage of transdermal drug delivery over alternative methods like oral, topical, intravenous drug delivery and so on. Transdermal medication delivery could be a comparatively new technology with a bright future. It has the potential to reduce the requirement of needles within the administration of a wide range of medication, however the cost component is essential. This article offers a general summary of the transdermal Drug Delivery System (TDDS), its advantages & disadvantages, factor affecting transdermal drug delivery and types of transdermal patches are also added here.

Keywords: Transdermal drug delivery, Bioavailability, First-pass metabolism.

Introduction:

The skin is an ideal route for medication delivery, in terms of accessibility and easy application. For thousands of years, creams and lotions are applied to the skin and local tissues for cosmetic and therapeutic functions [1]. Any drug delivery system's purpose is to deliver a therapeutic quantity of drugs to the proper place within the body at the proper time to attain and maintain the acceptable drug concentration. Recently, transdermal drug administration for general impact has been developed, with a variety of transdermal treatment systems (mostly patches) being offered [2,3]. Locally applied medicaments within the sort of patches that distribute medications for general effects at a pre-determined and controlled rate are referred to as Transdermal Drug Delivery Systems (TDDS). A transdermal drug delivery system, which may active or passive, could be a device that has a unique route for drug administration. The pharmaceutical drugs will be given through the epidermal barrier by using these devices [4,5]. All medication candidates that administer locally so as to push

drug absorption into the systemic circulation are included within the Transdermal Delivery System. This device will administer medications to the blood in a controlled and continuous manner through the skin. Many mixtures with totally different releasing properties are created to manage drugs release [6]. Transdermal Drug Delivery Systems (TDDS) are innovative drug delivery technologies that always need a clinical confirmation of a medicine's safety and effectivity [7].

Definition:

When applied to intact skin, transcutaneous drug delivery is characterized as self-contained, distinct indefinite quantity forms that give controlled, consistent administration of the medication. It additionally permits continuous administration of medication with short biological half-lives and removes periodic administration into the systemic circulation [8]. The TDDS has established itself as a very important part of latest drug delivery systems. A transdermal patch, additionally referred to as a skin patch, is a medicated adhesive patch that is applied to the skin and is employed to deliver a selected dose of medication into the blood [9,10]

Transdermal patches, are incredibly simple to use. A large dose of medication is applied to the inside of a patch that is worn on the skin for an extended period of time. A diffusion process allows the medication to enter the bloodstream immediately through the skin. Because the medication has a high concentration on the patch but a low concentration in the blood, it will continue to diffuse into the blood for a long time, maintaining a steady concentration of drug in the blood flow. As a new dosage form for potent drugs, transdermal drug delivery systems (TDDS) must be licensed based on clinical safety and efficacy studies [11,12].

The transdermal medicines dosage design aims to increase drug flux through the skin into the systemic circulation while reducing drug retention and metabolism in the skin. The uniform penetration of drugs over the skin allows for more consistent drug level in the serum, which is often a therapeutic goal [13].

Advantages of TDDS [14-17]:

- 1) Avoid first- pass metabolism of drug.
- 2) It can be utilized in individuals who are unable to take oral medications due to vomiting or diarrhea.
- 3) The medicine is released for a longer period of time, with a single application, extending the duration of activity.
- 4) Reduced dose frequency and patient compliance is improved.
- 5) The delivery system is not suitable for the drugs requires high blood levels.
- 6) Not used in acute conditions, only used in chronic conditions.
- 7) Long term adherence may cause patient's discomfort.
- 8) Used for drugs with a short biological half-life and a limited therapeutic window.
- 9) Predictable & extended duration of activity
- 10) Ability to deliver medicine to a certain location with improved accuracy.
- 11) A constant and optimal blood concentration-time profile was attained, resulting in fewer negative effects.
- 12) Avoidance of gastrointestinal incompatibility.
- 13) Self-administration is suitable

Disadvantages of TDDS [18-20]:

- 1) Only potent drug is suitable for TDTDDS.
- 2) Large doses of greater than 10 mg/day are difficult to deliver.
- 3) May cause itching, edema, skin irritation.
- 4) Not applicable for ionic drugs.

- 5) The Transdermal Delivery System is not suitable for the drugs requires high blood levels.
- 6) Not used in acute conditions, only used in chronic conditions.
- 7) Patients may experience discomfort as a result of long-term adherence.
- 8) Higher cost.
- 9) Drugs having a low or high partition coefficient do not reach the systemic circulation.
- 10) It's difficult to achieve high drug concentrations in the plasma.
- 11) The skin's barrier function varies from person to person as well as with age and different areas on the same person.

Factors affecting transdermal drug delivery [21-24]:

Physicochemical Properties of Penetrate:

A) Drug Concentration:

The flow is proportional to the concentration gradient across the barrier and the concentration gradient will be higher, if the concentration is higher across the barrier.

B) Molecular Shape & Size:

Drug absorption is inversely proportional to molecular weight because small molecules permeate faster than large molecules.

C) Partition Coefficient:

The optimal partition coefficient (K) is necessary for effective action. Drugs with a high K concentration cannot pass through the skin's lipid layer. Furthermore, drugs with a low K content will not be absorbed.

D) Diffusion Coefficient:

The diffusion coefficient of a medication determines its penetration. The properties of the drug, the diffusion medium, and their interaction at a constant temperature define the drug's diffusion coefficient.

Physiological & Biological Condition of Skin:

A) Skin Condition:

Acids and alkalis as well as a variety of solvents like chloroform and methanol, harm skin cells and promote penetration. The skin tissues are affected by the patient's illness. The unbroken skin is a better barrier, however the factors stated above have an impact on penetration.

B) Skin Age:

The skin of a foetus and a newborn appears to be more porous than that of an adult. Toxin absorption through the skin is particularly sensitive in children. As a result, skin age is one of the factors that influences drug penetration in TDDS.

C) Skin Hydration:

When skin comes into contact with water, its permeability increases considerably. Hydration is the most important aspect in promoting skin permeability. Humectants are used in transdermal delivery.

D) Skin Temperature:

As the skin temperature rises, the rate of drug penetration increases. Rise in skin temperature may cause dilatation of blood vessels in contact with the skin, resulting in increased percutaneous absorption.

E) Blood Supply:

Transdermal absorption can be affected by changes in peripheral circulation.

F) Species Difference:

Skin thickness, density of appendages and keratinization differ from species to species, affecting penetration.

G) Lipid Film:

The excretion of sebaceous glands and cell lipids such as sebum and epidermal cells, which contain emulsifying agents, form a thin lipid film on the skin surface that may offer a protective layer to prevent the removal of natural moisturizing factor from the skin and aid in the maintenance of the subcutaneous barrier function.

H) Regional Skin Site:

The thickness of the skin, the composition of the stratum corneum, and the density of appendages differ from one location to the next. These factors have a big influence on penetration.

I) Pathological Injury to The Skin:

The continuity of the stratum corneum can be disrupted by skin injuries, resulting in an increase in skin permeability.

Types of Transdermal Patches [25-28]:**A) Single Layer Drug-In-Adhesion:**

In this type, the drug is contained in the adhesive layer. The adhesive layer is responsible for drug release as well as adhere the several layers together and the overall system to the skin. A temporary liner and a backing surround the adhesive layer.

B) Multi-Layer Drug-In-Adhesion:

In the Multi-layer Drug-in-Adhesive, which is similar to the Single-layer Drug-in-Adhesive, the drug is incorporated directly into the adhesive. The system consists of many layers of drug-in-adhesive separated by a membrane. This patch also includes a temporary liner layer and a permanent backing.

C) Drug Reservoir In-Adhesion:

The Reservoir transdermal system is distinguished by the presence of a liquid compartment containing a solution or suspension of pharmaceuticals that is separated from the liner by a semi-permeable and adhesive layer.

The skin-adhering adhesive component of the product can be integrated as a continuous layer between the membrane and the release liner.

D) The Matrix System:

In the Matrix system, a semisolid matrix medicament layer keeps medication in the form of a solution or suspension that comes into direct contact with the release liner.

The layer of drug is partially covered by the adhesive layer in this device.

Conclusion:

In recent years, the Transdermal Drug Delivery System (TDDS) is the most extensively utilized method of drug administration for systemic as well as topical delivery without causing pain or rupturing the skin membrane. By designing the medicine as transdermal patches, we can address the problems associated with existing popular drug delivery. Topical application of medicinal substances has a number of advantages over traditional oral and invasive drug delivery methods.

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