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Review Article on Transdermal Drug Delivery System

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• ABSTRACT :

Transdermal patches are mainly used as cosmetic, topical and transdermal drug delivery systems. Ttransdermal patches represent a key outcome from the growth in skin science, technology , expertise developed through trial and error, clinical observation and evidence-based studies that date back to the first existing human records. This review begins with the quirk topical therapies and traces topical delivery drug system to the present day transdermal patches, describing along the way the initial trials, devices and drug delivery systems that underpin current transdermal patches and their actives. This is followed by consideration of the evolution in the various transdermal patch designs and their limitations as well as needs for active to be used for transdermal delivery system . The properties and issue associated with the use of currently marketed products, such as safety and regulatory aspects, are then described.

• KEYWORDS :

Dermis , epidermis , Transdermal , delivery , Pentration , permeability .

• INTRODUCTION :

Transdermal drug delivery system is called as patches dosage forms. This patches designed for deliver drug across a patient skin. This is a painless system of intake drugs systemically by applying a drug formulation on healthy skin. The drug firstly penetrates by the stratum corneum and then passes by depth epidermis and dermis without drug store in the dermal layer. When drug received in dermal layer then that available for systemic absorption through the dermal microcirculation.

Transdermal delivery provides a main margin over injectables and oral routes by increasing patient compliance and avoiding first pass metabolism respectively. This drug delivery system are not constant administration of drug .

Example of transdermal patches on the market that are applied to the skin of the trunk or the arm are Duragesic® (fentanyl), Androderm® (testosterone), Nitrodisc® (Nitroglycerine), Habitraol® (nicotine), Catapres-TTS® (clonidine), and Nicotrol® (nicotine).

The most common types of transdermal patch
therapies include the following:

Nicotine, Fentanyl and Buprenorphine, Hormones , Methylphenidate, Scopolamine ,

Nitroglycerin, Selegiline, Clonidine.

• FACTORS AFFECTING PERMEATION:-

The principle transport mechanism across the mammalian skin is by passive diffusion through primarily the transdermal route at steady state . The factors affect the permeability of the skin are classified into three categorys :

• CATEGORYS :-

Physicochemical properties of the permeate molecule :-

1) Partition co-efficient :-

Drug possessing by both water and lipid solubility are favorably absorbed through the skin.
Transdermal permeability co-efficient shows a linear dependence on partition co - efficient. Varying the vehicle may also alter a lipid or water partition co-efficient of drug molecule. The partition co-efficient of the drug molecule may be altere by chemical modification . Partition co-efficient is without affecting the pharmacological activity of the drug.

2) Molecular Size :

Molecular size is an inverse relationship existed between transdermal flux and molecular weight of the molecule. The drug molecule selected as candidates for transdermal delivery tend to lie within narrow range of molecular weight around the 100-500 Dalton .

3) pH Condition:

The pH mainly affects on rate of absorption of acidic and basic drugs . where as unchanged form of drug has better penetrating capacity. . According to pH hypothesis are only the unionized form of the drugs can permeate through the lipid skin barrier in significant amounts.

• PHYSIOLOGICAL AND PATHOLOGIC CONDITION OF SKIN :

a. Skin age:

Foetal and infant skin rise to be most permeable than mature adult skin . Therefore transdermal absorption of topical steroids occurs most rapidly in children and then adults. water permeation has shown to be same in adults and children.
b. Lipid film:

The thin lipid film on skin surface is formed by the sebaceous glands and cell lipids like epidermal cell which contain emulsifying agent may provide a protective film to prevent the removal of natural moisturising factor to the skin and h maintaining the error of the SC function .

c. Skin hydration:

Hydration of SC can enhance transdermal permeability. The rate of penetration study of salicylic acid via skin with dry and hydrated corneum shows that when the tissues were hydrated and the rate of penetration of the most water-soluble esters .

d. Skin temperature:

Rise skin temperature results an increase in the rate of the skin permeation. Rise in skin temperature may also increase vasodilation of blood vessels and contact with skin leading to an increase in percutaneous absorption.

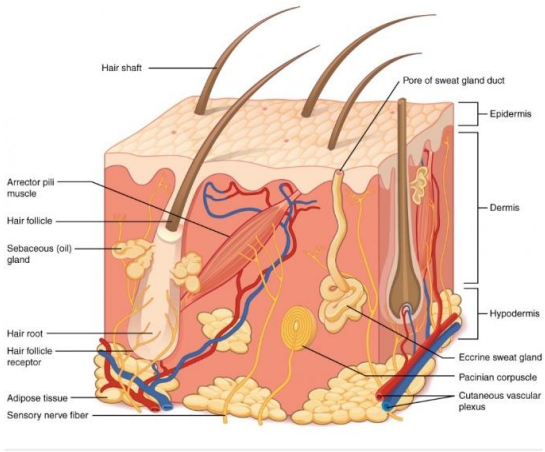
• PHYSIOLOGY OF THE SKIN :

Skin are a largest organ of animal body . Skin of adult body cover a surface of correctly 2 m and receives about one third part of the blood circulating via the animal body. Skin consist mainly three layers Epidermis , dermis and hypodermis.

uppermost layer is epidermis which has morphologically distinct regions;

1) Basal layer
2) Spiny layer
3) Stratum granulosum
4) Stratum corneum

Upper most layer was stratum corneum and it consists of highly dead cells . These extracellular membranes are unique in their compositions of ceramides, cholesterol and free fatty acids. The human skin surface is also known to contain 10-70 hair follicles and 200-250 sweat ducts on each square cm of the skin area. It is one of the moBBBst readily accessible organ of the human .



• SKIN PATHWAY FOR TRANSDERMALDRUG DELIVERY SYSTEM :

When drugs are applied on the skin surface, penetration into and through the skin can occur through various routes. Drugs penetrate either through the stratum corneum or through the appendage. During penetration through the stratum corneum, two possible routes can be distinguished, 1)Penetration alternating through the corneocytes and the lipid lamellae (transcellular route).
2) Penetration along the tortuous pathway along the lipid lamellae (intercellular route).

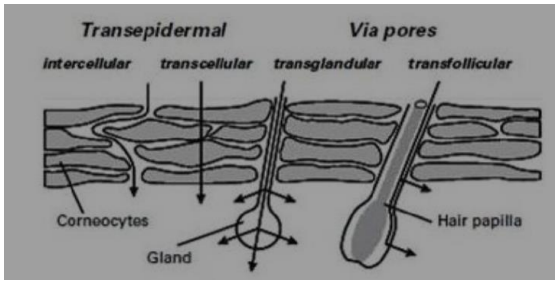


Fig. Possible pathway for permeation of drug across the skin barrier

• ADVANTAGE OF TDDS :

1. Alternative route.
2. Improved patient compliance.
3. steady infusion.
4. Reduced side effects.
5. No interaction with gastrointestinal fluids.
6. Avoid FPM.
7. Self administration.
8. Flexibility of termination.
9. Stable blood levels.

• DISADVANTAGES OF TDDS :

1. Variation in barrier function (age, site).
2. Pulsatile drug release.
3. Low drug levels in blood / plasma.
4. Molecular size restrictions (<500 Dalton).
5. No ionic drug delivery.
6. High cost.
7. Low permeability limits.

8. uncomfortable.

• LAYERS OF TRANSDERMAL PATCHES :

1. Impermeable backing membrane.
2. Drug reservoir.
3. Semi - permeable membrane.

4.Adhesive layer.

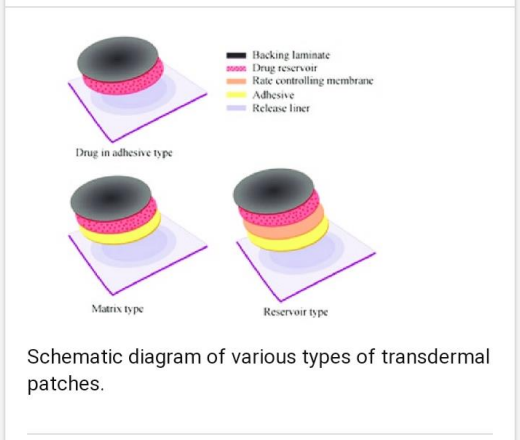
• SIZE OF TRANSDERMAL PATCHES:

The transdermal patch is available in 10-mg (12.5 cm^2), 15-mg(18.75cm^2), 20-mg(25cm^2), 30-mg(37.5cm^2).

• TYPE OF TRANSDERMAL PATCHES:

There are four main type of transdermal medical patches :

1) Drug - in adhesive system.
2) Reservoir system .
3) Matrix system.
4) Micro - reservoir system.



Schematic diagram of various types of transdermal patches.

1) Drug - in adhesive system:

This is a simplest form of membrane permeation control system. Pressure - sensitive adhesive (PSA) is one of the most critical compounds used in a TDDS.
Example of drug in adhesive system Acrylic, polyisobutylene and silicone - based adhesive.

2) Reservoir system:

The drug reservoir is held between the backing layer and the rate - controlling membrane and drug is released through the microporous rate - controlling membrane.
The bound drug in the blood stream may act as a reservoir for the drug.

3) Matrix system:

Drug are informally dispersed in hydrophilic or lipophilic Polymer material. Matrix system is a combination of chemotherapy and targeted drug therapy . It is used in treat primary CNS lymphoma.

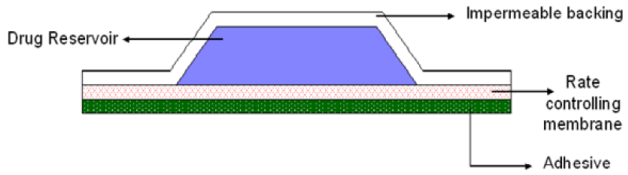
4) Micro - reservoir system:

Micro - reservoir system is made up of the three components are the drug reservoir , the rate - controlling membrane , and the adhesive. This system is a combination of reservoir system and Matrix dispersion system.

• MECHANISM OF TRANSDERMAL PATCHES :

Transdermal patches use for delivering medication through the skin . The patch contains the active drug . Drug is absorbed through the skin layers into the bloodcirculation and bypassing the digestive system. The patch used various mechanisms to for this absorption, such as chemical enhancers, micro-needles . These mechanisms ensure a controlled delivery of the medication.

Figure : TRANSDERMAL PATCHE



1) IONTOPHORESIS :

Iontophoresis passes a few milliamperes of current to a few square cm of skin through the electrode placed in contact with the formulation , which make the smooth path of drug delivery across the error. Iontophoresis mainly used of pilocarpine delivery to induce sweating . It is delivery system of lidocaine appears to be a promising approach for rapid onset of anesthesia.

2) Electroporation :

Electroporation is a method of application of high-voltage electrical pulses to the skin. The electrical pulses are believed to transient aqueous pores to the stratum corneum, through which drug transport occurs. It is a painless method using closely area electrodes to conrain the electric field within the nerve-free stratum corneum.

3. Application by ultrasound :

Application of ultrasound, particularly low frequency ultrasound, has been shown to enhance transdermal delivery of various drugs . It is also known as sonophoresis. Katz et al. reported on the use of low-frequency of ultrasound for topical delivery of EMLA cream.

4. Use of microscopic projection

Transdermal patches with microscopic projections called microneedles and it is used to make Smooth path for transdermal drug delivery . the range of the microscopic projection is 10 to 100 um in length. the arrays make microscopic punctures that are large enough to deliver macromolecules, but small enough that the patient dose not

feel the pain. The drug surface coated on the microneedles . Microscopic projection are used in development of cutaneous vaccines . in this type various other methods are also used for the transdermal patches like thermal Poration, Magnetophoresis, and Photomechanical waves .

CONCLUSION :-

Transdermal delivery system is painless way to deliver dose of many medications. Drug can be delivered improved drug uptake minimum complications . Transdermal delivery of product are currently approved as oral dosege form and allow for avoidance of first pass metabolism. Dermal patchs are most common dosage form of transdermal drug delivery system.

•REFERENCE :-

1. D.Prabhakar , J.sreekanth , K.N.Jayaveer. Transdermal drug delivery patches . Journal of drug delivery and therapeutic; 2013(4) , 213 - 221

2. Dr . K.P .sampth kumar , Dr. Debjit Bhowik , Dr. Ram Kumar Sahu , Dr. Subhash Debnath.
Novel drug delivery system , Nirali Prakashan. Page No. 6.1-6.14

3. Merugu Rajashekar , Design and study of transdermal drug delivery system in humans ,
Reservoir system. https:// WWW . google.com / images.

4. Dipen patel , Sunita A. Chaudhary , Bhavesh paramar , Nikunj Bhura . Transdermal drug delivery system www. therapeuticJournal .com 2012

5. Ramteke K.H. , Dhole S.N. , Patil S.V. Transdermal drug delivery system . Journal of advanced scientific research 2012 , 3 (1) :
22-35

6. J . Gordon Betts , Peter Desaix , Anatomy and Physiology , Connexions web site.
https://cnx.org/content/ co/11496/1.6/ Jun .
19.2013

7. D.Prabhakar , J. Sreekanth , K.N. Jayaveera ., Skin Pathway for transdermal drug delivery system. Journal of drug delivery and therapeutics 17July 2013 . https://images.app.google./JgGVNrpzLfESVPwVS