

# A SHORT REVIEW ON TRANSDERMAL DRUG DELIVERY SYSTEM (TDDS)

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## Abstract:

TDP is used to cure the wounded part of the body. This delivery system is one of the useful methods over the other types of method conveyance such as oral, intramuscular topical, and intravenous. This novel drug delivery not only improves the safety, efficacy but also improves the patient compliance. The main purpose of this system is to transmit the drug to the blood stream. That's why parenteral and oral routes are the most convenient routes of this delivery system. In this present review we will discuss about transdermal patches and their advantages and disadvantages, and the polymers which used in the delivery mechanism of TDDS. Such as, Gelatin, wax, gum and chitosan are the natural polymers. When the skill of the drug to permeate skin in sufficient quantities to achieve the desire pharmacological effects, it leads to the success of TDDS.

**Keywords:** Transdermal patches, Controlled release, Polymers, Advancement and past

## Introduction

This patch is put on the skin to convey a proper amount of medication which directly goes within the blood circulation<sup>1</sup>. TDP is used to cure the wounded part of the body. This delivery system is one of the useful methods over the other types of method conveyance such as oral, intramuscular topical, and intravenous. This system provides a controlled release of drugs to the patient's body<sup>2</sup>.

This novel drug delivery not only improves the safety, efficacy but also improves the patient compliance<sup>3</sup>. The main purpose of this system is to transmit the drug to the blood stream<sup>4</sup>. That's why parenteral and oral routes are the most convenient routes of this delivery system. "In this most of the small molecule medication is delivered orally". It is the painless method for delivering the drug<sup>5-7</sup>.

The medicine briefly reaches via the stratum corneum and then spreads over in the depth of the epidermis and dermis without the accumulation of drugs into the dermal layer.

It became accessible for systemic absorption by dermal microcirculation at the point where the drug enters the dermal layer<sup>8-9</sup>. "Skin is the body's largest and most important organ and has a surface area of 1.7 m<sup>2</sup>, adjusting 16 percent of the overall body mass of the person<sup>10-12</sup>. The key function of the skin is to allow a protective shield against microorganisms, ultraviolet radiation permeation, contaminations, allergens, and water loss between the body and the external world.

There are three major skin area, which are

- First layer, the epidermis, which carry the stratum corneum;
- Center layer, the dermis and
- The third layer is hypodermis<sup>14-15</sup>

1. **Epidermis:** It is the first layer of the skin where the width of the palms of the hands and soles of the feet is approximately 8mm<sup>16</sup>.
2. **Dermis:** The thickness is about 2-3mm and comprises of collagenous and elastin fibers 70% which gave strength and elasticity to the skin.
3. **Hypodermis:** It is the deepest layer of the skin that is made up of a fat cell network<sup>17</sup>.

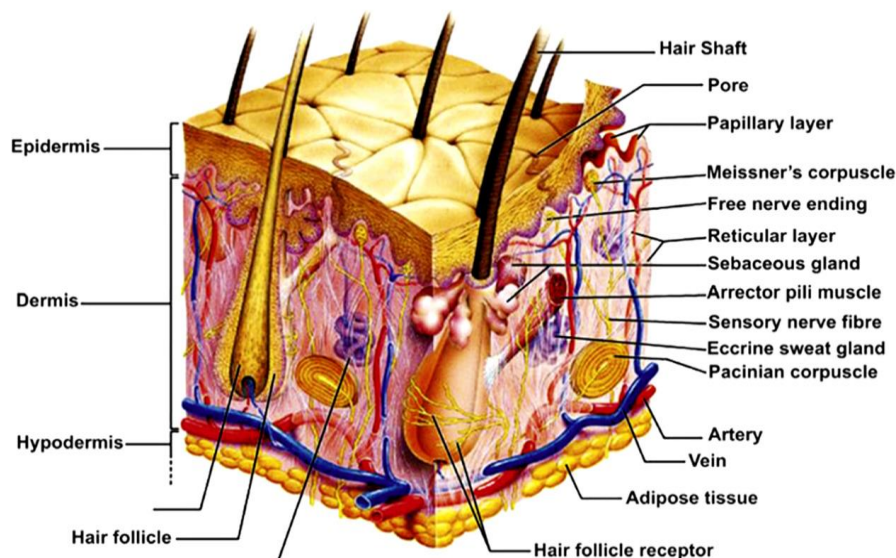


Fig.1. Elaborating on the structure of the skin (adopted from Alexander et al. 2012)

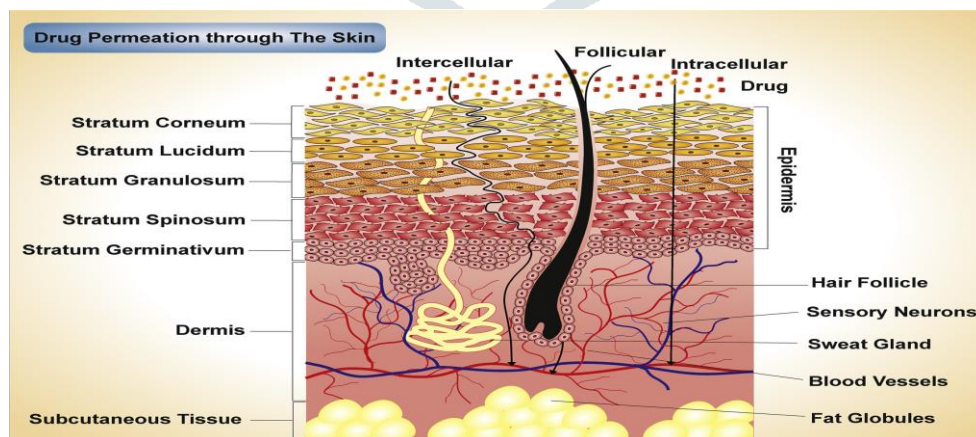


Fig.2. Different pathways of drug penetration via different layers of skin.

**ADVANTAGES OF TDDS:<sup>(18-23)</sup>**

1.	“Avoidance of GI absorbance”.
2.	“Bypass of first pass metabolism”.
3.	As an oral route alternative
4.	“Rapid notice of care in the case of emergency along with the degree of immediate elimination of drug effects through patch removal”
5.	Gastrointestinal conflict prevention.
6.	Reducing undesired side effects.
7.	Bypassing stages of drug fluctuation
8.	Obtaining inter and intra patient variance
9.	It is quick to avoid counseling in this manner
10.	Arrange appropriateness for self administration
11.	The tremendous advantage of TDDS is where the patients are unconscious
12.	Such patches are economical.

**Drawbacks:**

- Such patches do not deliver ionic medicine.
- Such patches are unable to reach high levels of medicine in the blood.
- It can not encourage drugs of large molecular size.
- Such patches are unable to transmit pulsatile sedates.
- It can not create a drug that can cause skin irritation.
- There may be conditions of local discomfort at the point of use.
- An allergic reaction can be caused by transdermal patches.
- Another downside is that only powerful drugs are acceptable candidates for these patches.
- Long-term adherence is hard.

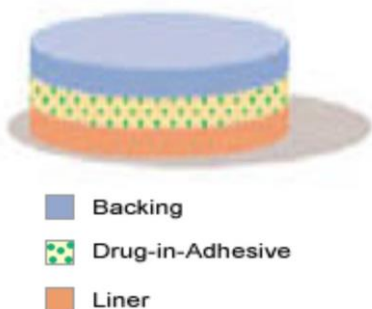
**Polymer used in the delivery mechanism of TDDS<sup>24</sup>**

Polymers are the TDDS pillar that governs the arrival of the medication from the gadget. These arrangements were set up by scattering the medication in the fluid base formed by fluid or strong state. They are also giving a predictable and solid drug conveyance of realistic usability over the expected shelf life of the products and should be of safe status.

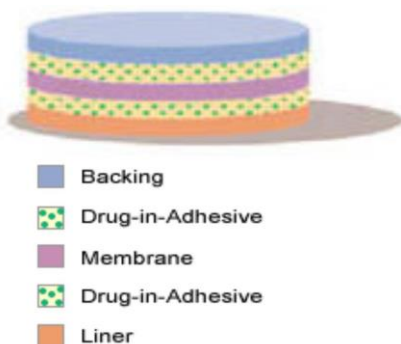
S.No.	Polymers	Examples
1.	Natural polymers	Gelatin, wax, gum, and chitosan.
2.	Synthetic elastomers	Polyisobutylene, silicon, Polybutadiene, neoprene, etc.
3.	Synthetic Polymers	Polypropylene, polyacrylate, polyvinyl and pyrrolidone.

### Types Of Transdermal Drug Delivery System:<sup>(25-29)</sup>

- a) **Single layer drug in adhesive:** The drug is found in the adhesive layer. The adhesive layer not only disperses in this form of a transdermal patch to adhere to the various layers together, but it is also responsible for releasing medicine to the skin. A short lived liner and a backup are limited to the adhesive sheet.



- b) **Multi layer adhesive drug:** Such patches are also the same as single layers, but rapid drug release layers can also be used. In this release of a drug, the adhesive layer is responsible. A short-lived liner-layer and a lasting endorsement for this patch.

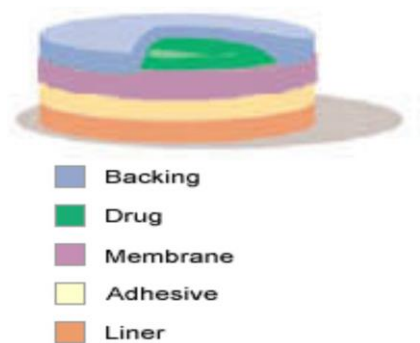


**b) Vapour Patch:**

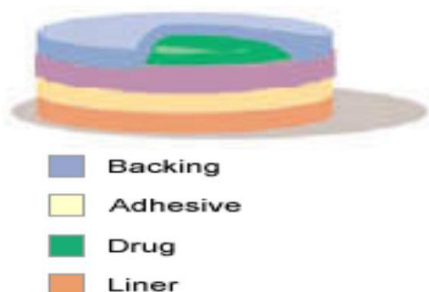
Not only are multiple layers delivered together in this adhesive layer, but it also helps to convey vapour. These are new to the market and are widely used in the decongestion process to discharge essential oils.

There are also other types of patches available on the market that are used to promote the quality of sleep and minimize cigarette smoking conditions as well.

- c) Reservoir system:** There's a different drug layer in this scheme. The drug layer containing the medication solution's fluid compartment or suspension is differentiated by the adhesive layer. Hypoallergenic adhesive polymer can be used as an outer surface or drug compatible polymer membrane surface.



- d) Matrix system:** This semisolid matrix provides a solution for medicine. The adhesive layer adjacent to the drug layer in this patch slightly overlays it.



- e) **Micro Reservoirs system:** A mixture of reservoir and matrix dispersion structure is this conveyance. The drug reservoir is collected by first suspending the medication in an aqueous watersoluble polymer solution, then uniformly dispersing the solution in a lipophilic polymer to design thousands of distant, microscopic drug reservoir spheres.

## Transdermal Patches Evaluation Parameters<sup>30</sup>

The physical parameters of weight variance, folding durability, and thickness of different films have been resolved.

**1. Organoleptic properties:** The color, transparency, adaptability, and smoothness of manufactured patches are visually tested here.

**2. Thickness Uniformity:** Transdermal film thickness was detected by measuring the each formulation by using digital Vernier calipers and calculating the mean after that.

**3. Weight variation:** Five matrices of each composition were identified in this uniformity of weight by gauging. After weighing each film individually, the average weight of the film was taken at the point

**4. Folding Endurance:** It is measured by folding the film repeatedly in the same position before the film splits. Then count how many times, it folded without splitting, and then the value should be determined.

### 5. Moisture content:

In this formulation prepared films are weighed separately and then processed for 24 hours in desiccators. In a desiccator containing at room temperature calcium chloride. The percentage content of moisture was measured via this formula.

$$\% \text{ Moisture content} = [\text{Initial weight} - \text{Final weight} / \text{Final weight}] \times 100$$

**6. Moisture Uptake:** “The prepared films are individually weighed” and then processed for 24 hours in desiccators. Desiccator containing potassium chloride saturated solution at room temperature until a constant weight is established.

$$\% \text{ Moisture Uptake} = [\text{Final weight} - \text{Initial weight} / \text{Initial weight}] \times 100$$



**7.Tensile Strength:** By using the tensiometer, this transdermal patch was found.

There are two load cell grips in this tensiometer and the lower was set and the upper was movable. In the center of these grips, the dimensions of film strips were set, and then force was continuously applied until the film separated and then the elasticity was taken<sup>31-33</sup>.

## Background of Some Researches:<sup>34-38</sup>

S.No.	Formulation	Summary	Uses
1.	“Jadhav.R et al were prepared”. “The formulation and the evaluation of transdermal films of diclofenac sodium ”.	“In this study the transdermal films of Diclofenac Sodium were prepared by utilizing the natural polymer, plasticizer gelatin and glycerin in various proportion”.	It is used in musculoskeletal disorders, toothache arthritis etc.
2.	“Tawde.S,et al were prepared”. “Evaluation of the vaccine against microparticulate ovarian cancer through the transdermal delivery route”.	“In this formulation, the whole cell lysate of a murine ovarian cancer cell line was used to prepare the microparticulate vaccine”.	It absorbed antigen to stimulate the immune response
3.	“Kharia, A et al were prepared”. “Formulation and examination of the Transdermal Patch used in Inflammatory C are”.	“In this formulation, we found that a transdermal delivery of Quercetin medication can be produced as a oncedaily dosage type”	Corticosteroids is also used for the treatment of inflammation
4.	“S.Sharda et al were prepared”. “Invitro and in vivo formulation for successful transdermal delivery of risperidone loaded proniosomes ”.	“In this formulation, we noticed that risperidone proniosomes were optimized and we overcame the bioavailability problems of orally administered risperidone in this research”.	Used in schizophrenia.

## Marketed Products of Transdermal Patches in Present Scinerio:<sup>40-47</sup>

In the market transdermal items have been in a crucial upward pattern in the industry that is likely to continue for what's to come. An expanding number of TDD products keep on conveying genuine remedial advantage to patients around the globe.

**Estradiol transdermal patch:** This patch can be used for the treatment of postmenstrual syndrome. This patch is also used to prevent osteoporosis in women.

**Fentanyl transdermal patch:** It was introduced in the 1990's. There are two different types of transdermal systems are available. So, the first one is a reservoir and another one is a matrix system. This patch can be used in the treatment of moderate and severe pain.

**Nicotine(NCT) transdermal patch:** This patch is used for the treatment of smoking cessation. This patch provides most of the advantages over conventional drug therapy. NCT is a pyridine alkaloid that is extracted from the tobacco plant.

**Transdermal Nitroglycerin Patch:** This Patch is manufactured by the Roberts Pharmaceuticals and Schwarz-Pharma. Nitroglycerin patch can be used for the treatment of angina pectoris.

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