IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

A Comprehensive Review on Transdermal Patch

Walunj Aditya A., Khandage Nilam R., Jadhav Nilam P., Burute Dinesh S., Shirke Abhidnya S.
Samarth Institute of Pharmacy, Belhe, Pune, Maharashtra, India

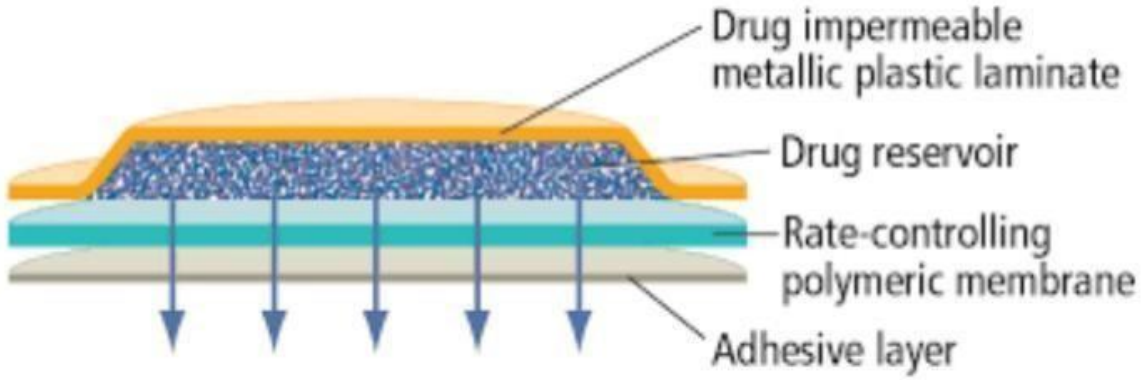
Abstract: *Transdermal patches are a non-invasive method of drug administration. It is an adhesive patch designed to deliver a specific dose of medication through the skin and into the bloodstream throughout the body. Transdermal drug delivery has several advantages over other routes of administration, for instance, it is less invasive, patient-friendly, and has the ability to bypass first-pass metabolism and the destructive acidic environment of the stomach that occurs upon the oral ingestion of drugs. For decades, transdermal patches have attracted attention and were used to deliver drugs such as nicotine, fentanyl, nitroglycerin, and clonidine to treat various diseases or conditions. Transdermal drug delivery systems (TDDS) are the dosage form of adhesive patch that is placed on the skin to deliver specific dose of medication through the skin and in to the blood stream. For the delivery of therapeutic agents through the human skin for systemic effects, the comprehensive morphological, bio physical and physicochemical properties of the skin are to be considered. An advantage of trans dermal drug delivery route over other type of medication is that a patch provides not only a controlled release, but also a constant administration of the drug and eliminates pulsed entry into the systemic circulation which often causes un desirable side effects*

Keywords: Transdermal patches

I. INTRODUCTION

A transdermal patch is a medicated adhesive patch that is placed on the skin to deliver a specific dose of medication through the skin and into the bloodstream. An advantage of a transdermal drug delivery route over other types of medication delivery (such as oral, topical, intravenous, or intramuscular) is that the patch provides a controlled release of the medication into the patient, usually through either a porous membrane covering a reservoir of medication or through body heat melting thin layers of medication embedded in the adhesive.

The main disadvantage to transdermal delivery systems stems from the fact that the skin is a very effective barrier; as a result, only medications whose molecules are small enough to penetrate the skin can be delivered by this method. The first commercially available prescription patch was approved by the U.S. Food and Drug Administration in December 1979.



Transdermal patches have been produced to release the drug in a controlled manner. Hokunalin Tape comprises tulobuterol (a β2-adrenergic agonist) that is mainly used as a bronchodilator for the treatment of asthma and chronic obstructive pulmonary disease.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

The patch consists of a baking layer at the top followed by an adhesion layer at the bottom. In this technology, drug molecules are uniformly dissolved in the adhesion layer, and simultaneously, drug crystals reservoir systems are uniformly dispersed in the same adhesion layer. When the drug is transferred from the adhesion layer into the skin, the drug from the crystal reservoir gets dissolved. It is dispersed into the adhesion layer, thereby maintaining a constant drug concentration inside the adhesion layer. As it is discussed in the application section that the chances of an asthmatic attack are more during the night near 4:00 a.m., the patch should be applied near 8:00 p.m. so that therapeutic concentration of tulobuterol is achieved before 4:00 a.m. so that the drug can be released in a sustained manner till morning.

Advantages

1. Hepatic first-pass metabolism, salivary metabolism, and intestinal metabolism are avoided. 2. The ease of usage makes it possible for patients to self-administer these systems.

In case of an emergency, removing the patch at any point of time during therapy can instantly stop drug input.

Since the composition of skin structurally and biologically is the same in almost all humans, it is minimal inter and intrapatient variation.

Drugs showing gastrointestinal irritation and absorption can be suitably administered through the skin.

Disadvantages

1. There is the possibility of skin irritation due to one or many of the formulation components. 2. Binding of the drug to the skin may result in dose dumping.

It can be used only for chronic conditions where drug therapy is desired for a long period of time including hypertension, angina, and diabetes.

Lag time is variable and can vary from several hours to days for different drug candidates. 5. Cutaneous metabolism will affect the therapeutic performance of the system.

Types of Transdermal Patch

Single-layer Drug -in-Adhesive

The adhesive layer of this system also contains the drug. In this type of patch the adhesive layer not only serves to adhere the various layers together, along with the entire system to the Skin, but is also responsible for the releasing of the drug. The Adhesive layer is surrounded by a temporary liner and a Backing.

Multi-layer Drug-in-Adhesive

The multi-layer drug-in adhesive patch is similar to the single-Layer system in that both adhesive layers are also responsible for the releasing of the drug. The multi-layer system is Different however that it adds another layer of drug-in –Adhesive, usually separated by a membrane (but not in all Cases). This patch also has a temporary liner-layer and a Permanent backing.

Reservoir

Unlike the Single-layer and Multi-layer Drug-inadhesive Systems the reservoir transdermal system has a separate drug layer. The drug layer is a liquid compartment containing a Drug solution or suspension separated by the adhesive layer. This patch is also backed by the backing layer. In this type of system the rate of release is zero order.

Matrix

The Matrix system has a drug layer of a semisolid matrix containing a drug solution or suspension. The adhesive layer in this patch surrounds the drug layer partially overlaying it.

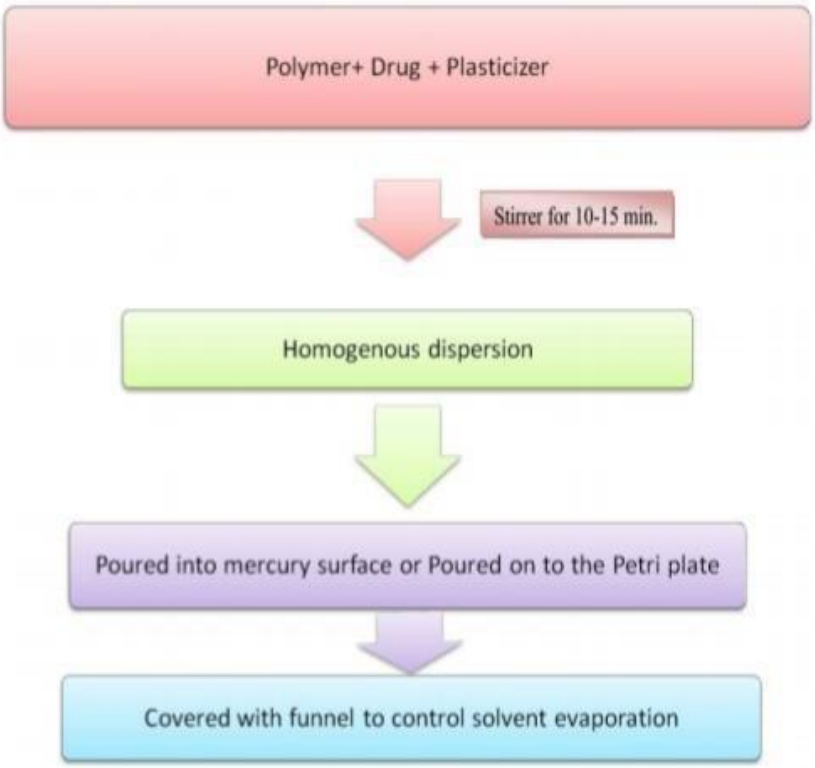
Vapour Patch

In this type of patch the adhesive layer not only serves to adhere the various layers together but also to release vapour. the vapour patches are new on the market and they release essential oils for up to 6 hours. The vapours patches release

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

essential oils and are used in cases of decongestion mainly. other vapour patches on the market are controller vapour patches that improve the quality of sleep. Vapour patches that reduce the quantity of cigarettes that one smokes in a month are also available on the market.

Method of Preparation



Transdermal drug delivery

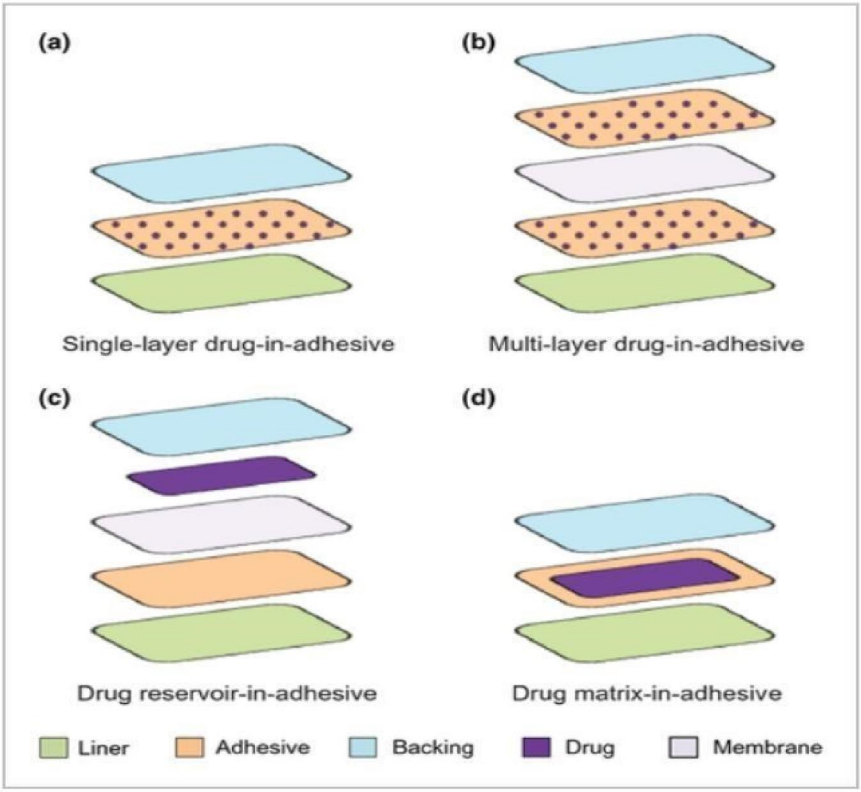
Transdermal drug delivery can achieve systemic treatment of diseases via the transdermal route. It offers the advantages of avoiding hepatic first-pass effect, good patient compliance and decreased dosing frequency. However, the natural barrier of the skin presents an obstacle for most drugs to be delivered into and through it. Liposomes, especially the ultra-deformable liposomes (also named transfersomes), are the promising carriers for transdermal drug delivery as they can overcome the stratum corneum barrier of the skin with an efficiency similar to subcutaneous injection. As shown in Fig. 8, there are three skin penetration routes for nanoparticles: Intercellular route, transcellular route and transfollicular route. Here, the membrane fluidity and elasticity of liposomes have been proved to play an important role in penetrating the skin through intercellular and transfollicular route.

Site of application

The site of application has been demonstrated to affect human skin penetration fluxes (Pastore et al., 2015). Many parts of the body (trunk and upper arm) appear to have similar fluxes allowing for interchangeable placement of patches to achieve similar plasma concentrations over recommended wear time (Pastore et al., 2015). Testosterone, nicotine, norelgestromin, oestradiol and clonidine all have evidenced similar drug plasma concentrations, with similar uptake at different skin sites. However, studies have shown that Rivastigmine had demonstrated higher plasma exposure after application to the upper back, chest or upper arm versus the thigh or abdomen (Pastore et al., 2015). Details of these

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

studies can be accessed (Pastore et al., 2015), but it is important to follow the advice of trained medical professionals for application to ensure that efficacy is attained by correct dosage and wear.

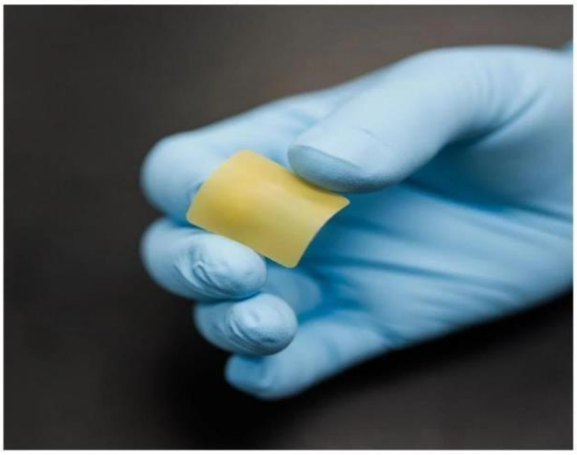


Effect of drug characteristics

The properties of a drug that enable good penetration through the SC can be deduced from the equation for steady-state flux (Margetts, 2007). When the cumulative mass of a diffusant, m, passing per unit area through a membrane is plotted, versus time t, the graph approaches linearity and the slope yields the steady flux dm/dt,.Where D is the diffusion coefficient, C0 the constant concentration of drug in donor solution, K the partition coefficient of solute between membrane and bathing solution, and h the thickness of the membrane. Therefore, for a drug to penetrate well, it should have low molecular mass (high D), adequate solubility in oil (high Co) and a moderately high partition coefficient (Margetts, 2007). This explains why all the drugs formulated into passive patches on the market have the narrow physicochemical and pharmacokinetic properties that they do. The commercial need for any new drug product is fulfilling an unmet medical need at a reasonable cost, that is achieving the required plasma concentration and transdermal delivery rate to be deemed efficacious, with advantages not yet achieved through current drug delivery techniques (Margetts, 2007). There are many drugs that are not suitable to formulate into TDP. If a very affordable, inexpensive, efficacious orodispersible already exists, or there is no commercial viability (patch is too large, drug cannot penetrate the skin, unacceptable activity, etc.), the drug in TDP form will not make the market (Pastore et al., 2015).

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

How transdermal patches work ?



There are two main subtypes of transdermal patch drug delivery systems: passive and active.

Passive vs. Active Systems

Passive transdermal patch drug delivery systems rely only on natural diffusion to transfer the drug from the patch to the skin and into the body. They provide a consistent diffusion rate, depending upon the characteristics of the skin and the design of the patch.

Active transdermal patch drug delivery systems use a specific method to aid in the transfer of the drug to the skin and into the body. These methods include chemical enhancers and permeators, physical aids like micro-needles, and low electrical current like iontophoresis. The amount of diffusion depends on the active method used, the drug characteristics, and the skin.

While transdermal patches are not ideal for every medication, they have proven successful for smallmolecule medications. They have also significantly improved medication adherence and delivery for patients with strong sensitivities to injections or oral medications.

Depending on the medication, some patches can also provide a higher and/or more effective dose of a medication as it is released over time. Through the use of patches, medicine can also be directed to a specific area of pain rather than a general body pain reliever.

Additionally, transdermal patches show promise for future medications as scientists close in on new ways to adapt patches for large-molecule drug delivery.

II. CONCLUSION

Trans dermal drug delivery route over other type of medication is that a patch provides not only a controlled release, but also a constant administration of the drug and eliminates pulsed entry into the systemic circulation which often causes undesirable side effects. It is non invasive technique which is less or no painful with long term action and no need of medical practitioner to apply it. So, it is easy to use and having constant drug release with respect to transdermal drug delivery system t also provides more patient compliance and cost-effective treatment. Transdermal medication delivery has limitations, including the potential for skin irritation, the inability to distribute ionic medicines, and that it is not appropriate for patients who are in shock or have poor peripheral blood flow.

REFERENCES

[1]. 1.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10142343/#abstract-a.n.b.ttitle2.https://ajpsonline.com/HTMLPaper.aspx?Journal=Asian%20Journal%20of%20Research
[2]. %20in%20Pharmaceutical%20Sciences;PID=2020-10-2-103. PRASANTH T A et al. Ijppr.Human, 2022; Vol. 23 (4): 283-298.
[3]. 284www.ijppr.humanjournals.com Disadvantages
[4]. https://onlinelibrary.wiley.com/doi/full/10.1002/mds3.10069

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 7, May 2024

[5]. https://en.wikipedia.org/wiki/Transdermal_patch
[6]. https://journaljpri.com/index.php/JPRI/article/view/6217.
[7]. https://www.sciencedirect.com/topics/pharmacology-toxicology-andpharmaceuticalscience/transdermal
[8]. A review on transdermal drug delivery system by ChetanGhulaxe, RameshwarVerma ,ISSN: 2277- 7695,TPI 2015; 4(1): 37-43 .
[9]. https://www.tapemark.com/blog/transdermal-patches?hs_amp=true
[10]. https://www.sciencedirect.com/topics/chemistry/transdermal
[11]. https://www.tapemark.com/transdermal-patches#chapter-2
[12]. https://www.sciencedirect.com/topics/pharmacology-toxicology-andpharmaceuticalscience/transdermal-patch
[13]. https://www.tandfonline.com/doi/full/10.1080/25740881.2024.2317408#:~:text=It%20also%20provides%20more%20patient%20compliance%20and%20cost%2Deffective%20treatment.&text=Transdermal%20medication%20delivery%20has%20limitations,have%20poor%20peripheral%20blood%20flow.
[14]. https://ajpsonline.com/HTMLPaper.aspx?Journal=Asian%20Journal%20of%20Research%20in%20Pharmaceutical%20Sciences;PID=2020-10-2-10.15.https://onlinelibrary.wiley.com/doi/full/10.1002/mds3.10069.