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A Brief Review on Transdermal Patches

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Abstract: *Transdermal drug delivery systems are a convenient way to administer medication. They use an adhesive patch to deliver medication through the skin and into the bloodstream. The patch provides a controlled release of medication and promotes healing. However, only medications with small molecules can be easily absorbed through the skin. This article provides an overview of transdermal patches, including their types, preparation methods, and efficacy factors.*

Keywords: Transdermal drug delivery system; Hydrin rubber; Silicon rubber; Polyvinylalcohol; Transdermal patch; Polyvinylchloride; Di-Nbutylphthalate; Triethylcitrate.

Abbreviations: PE: Polyethylene; EVAC: Ethylene Vinyl Acetate Copolymer; PSA: Pressure Sensitive Adhesive

I. INTRODUCTION

In the field of medicine, a transdermal drug delivery system has been developed to overcome the difficulties associated with drug delivery through the oral route. A transdermal patch is a type of adhesive patch that is applied to the skin for delivering medication into the bloodstream. It helps in healing an injured part of the body. The main advantage of transdermal drug delivery is that it controls the release of medication into the patient's system through a porous membrane covering a medication reservoir or through thin layers of medication embedded in the adhesive that melt by body heat. However, this method has a major drawback as the skin acts as an effective barrier, allowing only medications with small molecules to penetrate and be delivered through this method. This review article provides a comprehensive introduction to transdermal patches, including their types, preparation methods, and factors affecting their efficacy.

Although oral administration is the most commonly used method of drug delivery, it has certain drawbacks. These include first-pass metabolism and drug degradation due to enzymes and pH in the gastrointestinal tract. To address these issues, Chien, Banker, and Guy developed a unique medication delivery mechanism in 1992, 1990, and 1996, respectively. They invented a transdermal delivery device or patch that delivers therapeutically effective medication doses to the skin when applied. Transdermal patches come in various sizes and include different types of ingredients. They penetrate skin barriers to transfer active compounds into the systemic circulation once applied to intact skin. The patch delivers a long-lasting, high dosage of medication to the skin, which reaches the bloodstream through the diffusion process.

Three routes allow drugs to get through the skin:

a) Through hair follicles
b) Using sebaceous glands
c) Via a sweat duct.

Transdermal medication delivery devices are used for treating a variety of skin conditions, as well as angina Pectoris, pain, quitting smoking, and neurological conditions including Parkinson's disease.

TYPES TRANSDERMAL DRUG DELIVERY SYSTEM

Transdermal drug delivery systems come in different types.

The Drug-in-Adhesive System with One Layer involves the inclusion of medicine in the adhesive layer of the patch, which is responsible for both releasing the medicine and holding the various layers and the overall system to the skin. The adhesive layer is encircled by a temporary liner and a permanent liner.

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The Reservoir System, on the other hand, holds the drug reservoir between a membrane that controls the flow rate and a backing layer. The microporous rate membrane releases the medicine. The Micro-Reservoir System combines matrix dispersion and reservoir systems. The drug is suspended in an aqueous solution of a water-soluble polymer before being uniformly dispersed in a lipophilic polymer, forming millions of impermeable, tiny drug reservoir spheres.

The components of a transdermal drug delivery system include the polymer matrix/drug reservoir, drug, permeation enhancers, pressure-sensitive adhesive (PSA), backing laminate, release liner, and other excipients like plasticizers and solvents.

The polymer matrix/drug reservoir disperses the medication in a synthetic polymer base in either liquid or solid form. It should be compatible chemically and biologically with the medicine and other system components like penetration enhancers. It should also be safe and effectively distribute medicine consistently throughout the product's stated shelf life.

There are three categories of transdermal medication delivery system polymers, including natural polymers, such as chitosan, zein, gelatin, shellac, waxes, gums, and derivatives of cellulose, synthetic elastomers like polybutadiene, butyl rubber, hydrin rubber, silicon rubber, polyisobutylene, and acrylonitrile, and synthetic polymers, such as polyvinyl alcohol, polyvinyl chloride, polyethylene, polypropylene, polyacrylate, polyamide, polyurea, polyvinyl pyrrolidone, and polymethyl methacrylate, among others.

When manufacturing transdermal patches, it's essential to consider excellent pharmacological characteristics for the drug and ensure they are distributed consistently and effectively for the duration of the product's stated shelf life.

Factors Affecting Transdermal Patches

Various factors affect the action of Transdermal patches. These are given below:

a. Physicochemical Properties
i. Partition coefficient
ii. Molecular size
iii. Solubility/melting point
iv. Ionization
b. Physiological & Pathological Conditions of Skin
i. Reservoir effect of horny layer
ii. Lipid film
iii. Skin hydration
iv. Skin temperature
v. Regional variation
vi. Pathological injuries to the skin
vii. Cutaneous self-metabolism
viii. Skin barrier properties in the neonate and young infant
ix. Skin barrier properties in aged skin
x. Race
xi. Body site
Penetration enhancers used

Advantages

a) First-pass metabolisms of drugs are avoided.
b) Gastrointestinal incompatibilities are avoided.
c) Self-medication is possible.
d) Duration of action gets extended & and predictable.
e) Unwanted side effects get minimized.
f) Drug plasma concentration is maintained.
g) The number of doses gets reduced which improves patient Compliance.
h) The therapeutic value of many drugs gets increased By avoiding problems associated with drug-like lower Absorption, GI irritation, decomposition due to hepatic first-pass metabolism

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Disadvantages :

1. Chances of allergic reactions at the site of application Like- itching, rashes, locamediade, etc.
2. A larger molecular size of the drug (above 1000) creates Difficulty in absorption.
3. The barrier function of skin varies from site to site on the Same or different person.
4. Drug with hydrophilic character is less suitable as compared to drug with lipophilic character because of their Low permeability.

Evaluation of Transdermal Patches:

Physicochemical evaluation: -

a) Physical appearance patches were visually inspected for color, flexibility, homogeneity, and Smoothness.

b) Thickness: The thickness of the transdermal film is determined by a digital microscope, dial gauge, screw gauge, Or micrometer at different points of the same patch

c) Uniformity of weight: Weight variation is studied by individually weighing 10 randomly selected patches and Calculate the average weight of the patches.

d) Drug content determination: A correctly weighed section of patches (about 100 mg) is dissolved in 100 mL of suitable Solvent in which the drug is soluble and then the solution is shaken continuously for 24 h in a shaker Incubator. Then the whole solution is sonicated. After sonication and following filtration, the drug in Solution is estimated spectrophotometrically by appropriate dilution.

d) Moisture content: The films are weighed individually and placed in an indicator containing calcium chloride at Room temperature for 24 h. The films are removed and weighed again after a specified interval till they Show a constant weight.

e) Folding Endurance:

The evaluation of the folding endurance of the transdermal patches was done to determine the Folding capacity of the film subjected to frequent extreme conditions of folding. A strip of a specific area of 2.5 cm2 was cut evenly and repeatedly folded at the same place till it broke. The number of times the Patches folded at the same place without breaking was noted as its folding endurance value.

f) In vitro drug release studies:

The in vitro permeation of the drug from the patches was studied using a modified Franz Diffusion cell. It consists of 2 compartments, the donor compartment and the receptor compartment. The Donar compartment was in contact with the ambient conditions of the atmosphere and was in contact With a solution in the receptor compartment, which is pH 7.4 buffer, and was stirred by a magnetic bead And driven by a magnetic stirrer at a temperature of 32°C. The samples were withdrawn at the specified time Intervals of up to 8 hours and an equivalent volume of solution was replaced into the receptor compartment after Each withdrawal. And the percentage of drug release can be calculated.

II. CONCLUSION

When it comes to different cancer types, the transdermal method of chemotherapeutic drug administration is superior to oral and parenteral methods. The limited drug permeability through the SC to Reach the plasma concentration necessary for therapeutic effectiveness is a significant drawback of the Transdermal method. The bulk of chemotherapeutic medications, however, are quite strong and effective at Modest dosages. Transdermal dose formulations for chemotherapeutic drugs can therefore be a potential Strategy. Additionally, for a select few cancer types, such as breast and skin cancers, local medication Application to the skin over the hot spots can significantly reduce the size of the tumors as well as transport The medicine to the target location.

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