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A Review on Transdermal Drug Delivery System

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Abstract

Since 1981, transdermal drug delivery systems have been used as safe and effective drug delivery devices. Their potential role in controlled release has been exploited with high success rates by scientists worldwide. Transdermal delivery is a very effective delivery route when a drug has the right combination of physico chemistry and pharmacology. research is being done.

KEYWORDS: transdermal, drug delivery devices, controlled release

INTRODUCTION:

A transdermal drug delivery system is a drug that is topically applied in the form of a patch that delivers a drug at a predetermined, controlled rate for systemic action. Transdermal drug delivery systems have been in use for a long time. To date, the most commonly used system has been the topical application of dermatologic creams and ointments.Transdermal drug delivery is the non-invasive delivery of drugs from the surface of the skin, the largest and most accessible organ in the human body, through its layers into the circulatory system. TDDS has many advantages over traditional injection and oral methods. Transdermal delivery not only provides controlled and constant delivery of drugs, but also allows continuous delivery of drugs with short biological half-lives, reducing unwanted side effects of commonly used ingredients. Eliminates the pulsatile intrusion into systemic circulation that it often causes. The reasons for creating TDDS are:

• **Medicine:** The drug comes into direct contact with the release film. Examples: nicotine, methotrexate, estrogen.

Liner: Protects the patch during storage.

Example: polyester film.

Adhesive: Used to adhere patches to skin for systemic delivery of drug Examples: Acrolite, polyisobutylene, silicone.

· **Permeation enhancers**: control the release of active ingredients. Examples: Trepan, Threnodi, Pyrrolidone. Solvents such as alcohol, ethanol, and methanol. Surfactants such as Sodium Laurel Sulfate, Plutonic F127, Plutonic F68.

MYTHS ABOUT TRANSDERMAL DRUG DELIVERY:

MYTH 1:

The Transdermal drug delivery market is stagnant:

In fact, the transdermal market is on a distinct upward trend that is likely to continue for the foreseeable future. While it is true that the market has not exploded, the number of TDD products continues to grow and continue to provide real therapeutic benefits to patients across the world.There are currently over 35 TDD products approved for sale in the United States, and approximately 16 active ingredients worldwide approved for use in TDD products. Sales of TDD product in the US increased 23% from 2000 to 2001, and sales of in Europe increased 9% over the same period.

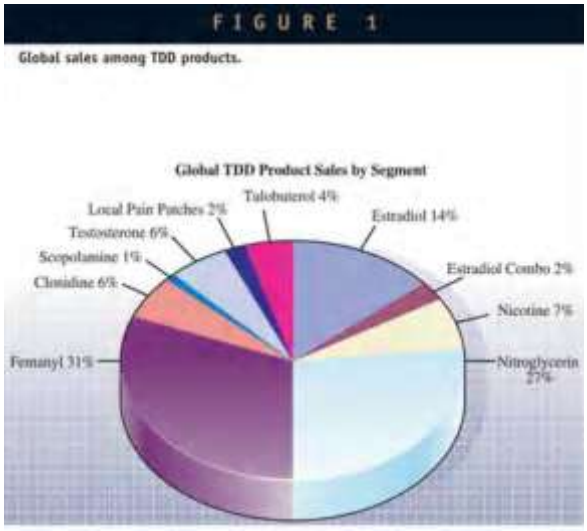

Fig 1: Global sales among TDD Product

MYTH 2:

Transdermal drug delivery is an old technology.

With interest in extending the functionality and capabilities of transdermal drug delivery, many significant innovations in TDD technology have occurred only in the last decade.
Where is transdermal drug delivery innovation happening? Most can be divided into two categories: system innovation and formulation innovation. Most system innovations include techniques that use different energy sources to increase drug flux across the skin.

MYTH 3:

All drugs that can be delivered transversally are already on the market.

In the first section, the market for transdermal delivery of drugs is growing, and it is discussed that this market is poised for higher growth in the next few years based on a strong pipeline of transdermal products in the clinical setting. increase. America. The transdermal drug delivery potential of has been greatly expanded by the application of new His formulation technology and His active delivery system.

MYTH 4:

Transdermal drug delivery systems are not suitable for delivery of biotechnology drugs, such as protein/peptide pharmaceuticals. New transdermal techniques have been developed to greatly expand the range of molecules that can be delivered cross-sectionally. Certainly the molecular size u The solubility properties of biopharmaceuticals such as proteins, peptides and carbohydrates prevent their passage through the skin, a membrane that is fairly efficient for the transport of macromolecules, preventing their use in typical passive transdermal systems as well as newer transdermal techniques. increase. We are making progress towards overcoming this barrier. Several newer transdermal techniques contain mechanisms that temporarily bypass the skin's normal barrier function, two of the better known techniques being iontophoresis and sonophoresis. . Both and polymer passages.

COMPONENTS OF TRANSDERMAL PATCH:

· **Liner -** protects the patch during storage. Liner is removed prior to use.

Drug – Drug solution in direct contact with the release liner.

Glue – Used to glue the Patch to his Skin as well as the components of the Patch.

Membrane – Controls drug release from reservoirs and multilayer patches.

Backing - Protects the patch from the external environment.

COMPONENTS OF TDDS

Polymer matrix / Drug reservoir

□□Drug

□□Permeation enhancers

□□Pressure sensitive adhesive (PSA)

□□Backing laminates

□□Release liner

□□Other recipients like plasticizers and solvents

Polymer matrix / Drug reservoir:

Polymers are the backbone of TDDS and control drug release from the device. Polymer matrices can be created by dispersing drugs in a liquid or solid synthetic polymer base. Polymers used in TDDS must exhibit biocompatibility and chemical compatibility with the drug and other components of the system, such as penetration enhancers and PSA.

Drugs: The transdermal route is a very attractive option for drugs with appropriate pharmacology and physicochemistry. Transdermal patches offer many benefits for drugs that undergo extensive first-pass metabolism, drugs with narrow therapeutic windows, or drugs with short half-lives that lead to non-compliance with frequent dosing. drugs for transdermal delivery. Additionally, drugs such as rivastigmine for dementia in Alzheimer's and Parkinson's disease, Retightening for Parkinson's disease, methylphenidate for attention deficit hyperactivity disorder, and Elegaising for depression have recently been approved as TDDS.

Permeation Enhancers:

These are compounds that increase the permeability of the corneal layer to achieve higher therapeutic concentrations of the drug candidate 32. Penetration enhancers are structural components of the conidia, namely proteins or Lipid. They alter the packaging of proteins and lipids in the layer Conium, thus chemically altering the barrier function of and increasing its permeability.

Pressure sensitive adhesives:

PSA is a material that helps maintain intimate contact between the transdermal system and the skin surface. It should stick with a finger press, be aggressive, permanently sticky, and have strong holding power. It should also be removable without residue from any smooth surface. Todd's commonly uses polyacrylate, polyisobutylene, and silicone-based adhesives.

Release Liner:

During storage, the patch is covered with a release liner, which is removed and discarded just before the patch is applied to the skin. As such, it is considered part of the primary packaging and not part of the dosage form for dispensing the drug.

Other excipients

Prepare drug reservoirs using different solvents such as chloroform, methanol, acetone, isopropanol, and dichloromethane. In addition, plasticizers such as dibutyl phthalate, triethyl citrate, polyethylene glycol, and propylene glycol are added to give plasticity to transdermal patches.

TYPES OF TRANSDERMAL PATCHES:

a) Single layer drug in adhesive: In this type, adhesive layer contains the drug. The adhesive layer not only holds the different layers together, but also serves to deliver the drug to the skin. The adhesive layer is surrounded by a temporary liner and backing.

b) Multi -layer drug in adhesive: This type is also similar to monolayer, but has one drug immediate release layer and another layer with adhesive layer for controlled release. The adhesive layer is responsible for drug release. This patch also has a temporary liner layer and a permanent liner.

c) Vapour patch: In this type of patch the role of adhesive

layer not only serves to adhere the various layers together but also serves as release vapor. The vapor patches are new to the market,.

EVALUATION OF TRANSDERMAL PATCHES:

The development of controlled release transdermal dosage forms is a complex process requiring extensive research. The transdermal patch is designed to improve the clinical efficacy of the drug and improve patient compliance by releasing small amounts of her drug at a predetermined rate. This makes evaluation studies even more important to ensure desired performance and reproducibility under specified environmental conditions. These studies are predictive of transdermal dosage forms and can be categorized into the following types:

□□Physicochemical evaluation

□□*In vitro* evaluation

□□*In vivo* evaluation

Upon the success of physicochemical and *in vitro* studies, *in*

vivo evaluations may be conducted.

PHYSICOCHEMICAL EVALUATION:

Thickness: Transcutaneous film thickness is determined by travel microscopy, dial gauges, screw gauges, or microns at various locations on the film.

Uniformity of weight: Weight variability is examined by weighing 10 randomly selected spots individually and calculating the average eight. Individual weight should not differ significantly from the average weight.

Drug content determination: An accurately weighed portion of film (approximately 100 mg) is dissolved in 100 ml of suitable solvent in which the active ingredient is soluble, and the solution is continuously shaken in a shaking incubator for 24 hours. Next, sonicate the bulk solution. After sonication and subsequent filtration, the drug in solution is measured spectrophotometrically by appropriate dilution.

ANIMAL MODELS:

Human volunteers:

Animal modelsSmall animal studies are preferred, as conducting studies in humans requires considerable time and resources. The most common animal species used to evaluate transdermal drug delivery systems include mice, hairless rats, hairless dogs, hairless rhesus monkeys, rabbits, and guinea pigs. Various experiments conducted have led to the conclusion that there are more hairless than hairy animals. animals are preferred for both in vitro and in vivo experiments. Rhesus monkeys are one of the most reliable models for in vivo evaluation of transdermal drug delivery in humans.

Human models The final stage of development of the transdermal device will involve the collection of pharmacokinetic and pharmacodynamic data following application of the patch to volunteers. Clinical trials were conducted to assess efficacy, risks, side effects, and patient compliance. A phase I clinical trial was conducted primarily to determine the volunteer's safety and a phase II clinical trial to determine short-term safety and primary efficacy in his patients. was carried out on Phase III trials demonstrate safety and efficacy in large patient populations, while Phase IV trials are conducted after marketed patches have been marketed to detect adverse effects of the drug.

Stability studies: Stability studies are performed to investigate the effect of temperature and relative humidity on the active substance content in different formulations. The transdermal formulation has undergone stability testing according to ICH guidelines.

CONCLUSION:

Since 1981, transdermal drug delivery system has been used as a safe and effective drug delivery device. Its potential role in controlled release has been exploited by scientists worldwide with high success rates. Transdermal delivery can be a very effective delivery route if the drug possesses the right combination of physicochemistry and pharmacology. Due to the great advantage of TDDS, many new studies are currently being conducted to integrate new drugs through the system. Transdermal patches have several basic components such as drug reservoirs, cover layers, adhesives, penetration enhancers, backing laminates, plasticizers and solvents, which play important roles in the release of drugs through the skin. fulfill. Transdermal patches can be divided into various types, such as matrix, reservoir, membrane-matrix hybrid, microreservoir, drug-in-adhesive type transdermal patches, and the basic components of TDDS are used to make these patches. Various methods are used to do this. After manufacturing transdermal patches, they are evaluated in physicochemical, in vitro permeation, skin irritation, animal, human, and stability studies. However, all
transdermal patches manufactured and evaluated are subject to FDA approval before can be marketed. Future development of TDDS may focus on increasing control of therapeutic regimens and continuing to expand the available agents. Transdermal dosage forms may offer physicians the opportunity to offer more therapeutic options to optimize patient care.

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