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IONTOPHORESIS DRUG DELIVERY SYSTEM: A REVIEW

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ABSTRACT

The goal of iontophoresis drug delivery system is the permeation of ionized drug molecules across biological membrane under the influence of electric current. The objective of iontophoresis is to provide excellent therapeutic management. The drug transport through iontophoresis was established to be near 10 to 2,000 time more than easy form of delivery. This technique make possible movement of ions across a membrane under influence of externally applied electric potential difference. The rationalae behind using this technique is to reversibly alter the barrier properties of skin which could possibly improve the penetration of drug to increase systematic delivery with control input kinetic and minimum intersubject variability. For permeation of ionic and non ionic drugs the delivery system of iontophoresis use as driving force to make better delivery rate of ionic compund. iontophoresis system is cleaved in this field design. In this review given introduction, principal, mechanism. Advantage, Disadvantages and It's applications.

KEYWORDS: Iontophoresis, Penetration enhancer, Stratum corneum.

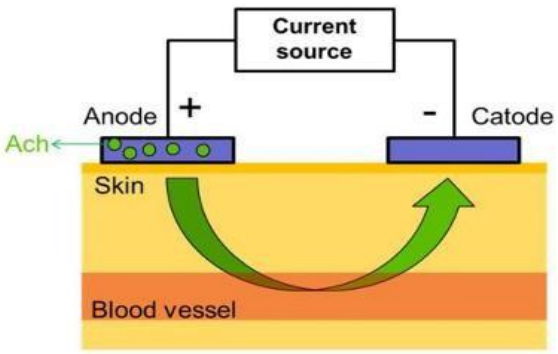
INTRODUCTION

The term iontophoresis simply define as ion transfer (Ionto-ion, phoresistransfer). If when low voltage and low current density is applied then in iontophoresis cationic or neutral therapeutic agents are keep under anode and anionic therapeutic gents are keep under the cathode. Iontophoresis is the physical method. For skin (Dermatological) in modern days pharmaceutical practice and therapeutic compunds are applied .in which skin is one of the most wide and easily accessible pragn in human body local (regional), transdermal (systematic), delivery. For passively penetrate the molecule into the skin act as

semipermeable membrane and which accept only very small quantity of any drug. The first report of iontophoresis had appeared in turn of the century when leudac demonstrate technique, by delivering strychnine and cynide into rabbit in 1908. Depending upon the delivery route there are many administration manner such as oral administration, transdermal administration, lung inhalation, mucosal administration, and intravenous administration. Transdermal administration passes the skin through stratum corneum. transdermal administration may be passive or facilitated in passive administration. The nonionized drug passes through the skin through stratum corneum. Among the earliest application of electric current for medical therapy was pivati in 1740 to treat arthritis.[1] More notable advances were made dure the 1800 by pioneering scientist such as Benjamin ward Richardson, William sames Morton and Frtiz frankenhauser the latter of whom coined the phrase iontophoresis in favour of cataphoresis, which had been used more commonly prior to the 20th century. It has proven to be a beneficial treatment for many localized skin disorders such as nail disease, herpies diseases, herpies lesion, psoriasis, eczematous and cutaneous T-cell lymphoma .it is painless, sterile, non invasive, The electricity is required for insertion of medicine in the body.[6-23]

Principal

In iontophoresis charges with similar signal repel and charges with the opposite signal attract helping for ions insertion into the skin and iontophoresis principal was derived by Du day. The drug is applied under an electrode of same charge as the drug and return electrode is placed at a neutral site on the body surface, the current below the level of patient pain threshold is allowed to flow. The repulsion of like charges and attraction of opposite charges in presence of electric current significantly increases the insertion of drug into the surface tissue.

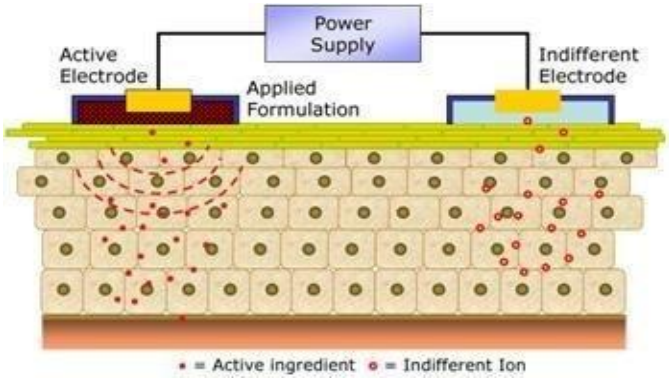


Mechanism

The primary channel for transport is through sweat gland.once they has passed through the outer layer of skin it reaches to its site of action. When a voltage difference is applied transport of iontophoresis mechanism consist of migration, diffusion or electro-osmosis which has large flow of fluid occure in similar direction. On application of electromotive force the drug is repelled and moves across the stratum corneum toward the cathode, which is placed elsewhere on body. flow occure from anode to the cathode elecrto-osmotically thus enhancing the flux cationic drugs.

Reverse iontophoresis

The use of electric current against the skin is used to extract a substance of excitement form within or beneath the skin to the surface or testing is also be used in diagnosing diabetes, cytis fibrosis.



Advantage

Electrode are not difficult to the manufacture and to be applied to the skin with minimum training

- Good correlation between glucose level in ISF and in the blood under stable conditions
- Virtually painless when properly applied
- Provides option for patient unable to receive injection.
- Minimizes potential for tissue trauma from an injection
- Reduced risk of an infection due to non-invasive
- Nature
- Treatment are completely in very less time.

Disadvantage

- Drug must be in aqueous solutions and must in ionized.
- Minor tingling, irritation, and burning can occure these symptoms can be decreased with proper procedure or adjusting the current.
- For the application of drug additional ions act like carrier or active competitors.
- The variation occure in current, density impendence, skin fat, thickness, ionisation, pH, therefore depth of penetrations must be varied.

Factors affecting iontophoresis[1 - 5]

Various factors have been observed that affect the mechanism of iontophoresis.

- Physiological properties of compound include

- Molecular size
- Charge
- Concentration of drug molecule

- **The solution**

It include buffer used, PH of solution and other compound present in solution.

- **Experimental factor**

- Current strength

It is convenient mean to control delivery of drug to the body .the current should not be applied more than 3 min because skin burn and irritation occure.

- Duration of application

The transport of drug delivery depend upon the duration of current applied in iontophoretic drug delivery.

- **Biological factor**

- Regional factor

With the help of systemic and underlying tissue solute absorption the dermal blood supply determine n iontohoresis.

- **Skin condition**

The properties of penetration also affect the skin conditions in iontohoresis.

Applications for the use of iontophoresis

Common conditions	Drugs
Calcium deposits	Acetic acid
Hyperhidrosis	Atropine sulfate
Spasm	Calcium
Scar tissue	Iodine
Athletes foot	Copper
Burns	Penicillin, Gentamicin sulfate
Inflammatory condition	Dexamethason
Local anesthesia	Lodocaine/epinephrine
Open wounds	Histamine,zinc oxide

1. Topical conveyance

The ability to control the delivery rate of drug by changes in current makes iontophoresis an attractive technique to use.yamashita et.al. examined the adequacy of iontophoretic conveyance of calcium for treating burns caused by hydrofluoric acid.

2. Hyperhidrosis

The treatment of hyperhydrosis is the successful application in iontohoresis. Recently more commonly used conducting medium is tap water the reason is it is very safe and effective. The clear meaning of hyperhidrosis is excess sweating usually the plantar and palmer region are affected iontophoresis is generally applied in treatment of plantar and palmar hyperhidrosis.

By using electric current which is passed through tap water and it is temporarily close off sweat gland according to hypothesis, iontohoresis may produce hyperkeratosis of sweat pores and obstruct sweat flow and secretion.

3. Opthamology

For delivering antibiotics in eye iontophoresis has been used experimentally. Due to presence of blood retinal barrier the penetration of drug through systematic circulation in eye is not easily achieved. The major disadvantage of this technique is the time required for direct contact of electrode with eye Based on the depth of penetration there are two types of iontophoresis-

1) Transcorneal therapy
2) Trans-scelral therapy

4. Dentistry

Dentistry is an physical therapy used in iontophoresis with patients prior to oral surgical procedure –

Treatment of oral ulcer, herpes, oralabialis lesions (Fever, blisters) using negatively charged corticosteroids and antiviral drugs respectively.

In dentistry silver compound have been used for more than century. it was found have medicinal properties silver fluoride, silver nitrate, silver diamine fluoride and other silver particle compound have been examined for management of caries. treatment of easily affected dentin by using charged fluoride particles.

5. Dermatology

Iontophoresis has been used for treatment of various dermatological conditions. iontophoresis with tap water or anticholinergic compunds has been used for the treatment of patient with hyperhidrosis of palm, Feet and Axillac.

6. Local anesthetics

When local anesthetics drugs are used there is loss of pain sensation. the lignocaine and epinephrine solution iontophoresis give immediate pain relief.

7. Diagnostic applications

In diagnostic appliations drugs pilocarpine produces intense sweating, allowing sufficient amount of sweat to be collected and analysed this now accepted primary test to diagnose of cystic fibrosis.

8. Future applications

Transdermal drug delivery has huge scope for medical treatment. to increase impact of iontophoresis in drug conveyance various combination of chemical and physical enhancer can be used with iontophoresis would make treatment cost effective.

CONCLUSION[2]

It should be apperent from this review iontohoresis maintain good promise for future drug delivery system. for treatment of local condition Iontohoresis drug delivery systems is use well for effective penetration of peptide and protein drug for existing compund at charged PH iontohoresis system is very useful.

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