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PHARMACY AND BIO SCIENCES****IMPACT FACTOR 4.018*******ICV 6.16*******Pharmaceutical Sciences****Review****Article.....!!!****SONOPHORESIS: THE NOVEL DRUG DELIVERY SYSTEM****Ms . Nagare Madhuri B* , Prof. Deshmukh Madhuri D**

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KEYWORDS:

Sonophoresis, Mechanism, Application, Ultrasound, Cavitation, Enhancement, Transdermal, Drug Delivery.

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ABSTRACT

There are numerous methods of administering drugs to the body, both passive and active. Active methods include the use of penetration enhancers and assisted drug delivery. One of them is sonophoresis (phonophoresis). This term is used to describe the effects of ultrasound on the movement of drugs through intact living skin and into the soft tissues. Although the exact mechanism of sonophoresis is not known, drug absorption may involve a disruption of the stratum corneum lipids allowing the drug to pass through the skin. In the future, drug release systems aided by ultrasound may be able to provide slow release of vaccines. Researchers are currently exploring the applications in various areas like cutaneous vaccination, transdermal heparin delivery, transdermal glucose monitoring, and delivery of acetyl cholinesterase inhibitors for the treatment of Alzheimer's disease, treatment of bone diseases and Peyronie's disease and dermal exposure assessment. Drug administration through skin patches, with the advent and development of ultrasound-mediated transdermal transport.

INTRODUCTION:

Sonophoresis is the enhancement of migration of drug molecules through the skin by ultrasonic energy. Sonophoresis occur because ultrasound waves stimulate micro vibrations within the skin epidermis and increase the overall kinetic energy of molecules. when sound is emitted at a particular frequency, the sound waves disrupt the lipid bilayer the higher the frequency the more dispersed the transmission.

ADVANTAGES:

- 1) It avoids vagaries associated with gastrointestinal absorption due to pH, enzymatic activity, drug-food interaction etc.
- 2) It substitute oral administrations when the route is unsuitable as in case of vomiting, diarrhea.
- 3) It avoids "first pass "effect.
- 4) It avoids the risks and inconvenience of parenteral therapy.
- 5) It reduces daily dosing, thus improving patient compliance.
- 6) It extend the activity of drug having short plasma half life through the reservoir of drug present in the therapeutic delivery system and its controlled release characteristics.
- 7) The rapid termination of drug effect by removal of drug application from the surface of the skin.
- 8) The identification of medication in emergencies.
- 9) Elimination of hazards and difficulties of intra venous infusion or intra muscular injections.
- 10) It enhance the therapeutic efficacy, reduce side effect due to optimization of blood concentration time profile and elimination of pulse entry of drug into the systemic circulation.
- 11) It provides predictable activity over extended duration of time and ability to approximate zero-order kinetics.
- 12) It improved the control of the concentration of drug with small therapeutic indices.
- 13) It minimizes the interpatient and interpatient variation.
- 14) It is suitable for self-administration.

LIMITATIONS:

- 1) Only limited number of potent drug can be absorbed in therapeutic dose.
- 2) Many systematically effective therapeutic drugs produces the skin irritations.
- 3) If the drug dosage required for therapeutic value is more than 10mg/day.the transdermal delivery will be very difficult.
- 5) The barrier function of the skin changes from one site to another on the same person from person to person and with age.

SONOPHORESIS: A HISTORICAL PERSPECTIVE:

Sonophoresis was shown to enhance transdermal drug transport about 40 years ago by fellinger ans schmidt,who showed that application of ultrasound increases transport of hydrocortisone across the skin. 15 more drugs including steroidal anti- inflammatory drugs[hydrocortisone, dexamethasone] non-steroidal anti-inflammatory drugs[Salicylates, ibuprofen],anaesthetic drugs[lidocaine] and proteins such as insulin were studied.hofman and moll who studied the percutaneous absorption of benzyl nicotinate. bommannan et al. hypothesized that since the absorption coefficant by the skin varies directly with ultrasound frequency.

UNDERSTANDING THE DRUG DELIVERY:

Sonophoresis or ultrasound can be used to create holes in the skin for fluids to travel into or out of the skin. by emitting the sound at a particular frequency, the sound waves disrupt the lipid bilayer of stratus cornea [outermost layer of the skin which has most barrier properties] creating more and larger micro channels in the skin. drug can be administered through these channels.

ULTRASONIC GENRATION SYSTEM:

Ultrasound is applied by bringing transducer in contact with the skin. For sonophoresis delivery, the desired drug can be dissolved in a solvent and applied to the skin. The coupling medium can be same as the solvent used to dissolve the drug or it can be a commercial ultrasound coupling. example: gel. It helps to match impedance of tissue with the impedance of trancducer,so that ultrasound gets properly into the tissue.

SELECTION OF ULTRASOUND PARAMETER:

The following factors are in consideration when we select the ultrasound parameter:

- 1) Ultrasound frequency.
- 2) Ultrasound intensity.
- 3) Pulse length.

BIOLOGICAL EFFECT OF ULTRASOUND:

Significant attention has thus been given to investigating effect of ultrasound on biological tissues.

The ultrasound effects on biological tissues via three main effects:

- a) Thermal effects.
- b) Cavitation effects.
- c) Acoustic streaming.

GENERATION OF ULTRASOUND:

Ultrasound is a sound wave possessing frequencies above 20KHz.these waves are characterized by two main parameters, frequency and amplitude. The waves used for sonophoresis which reduce the

resistance offered by SC lie in the frequency range of 20KHz to 20MHz. ultrasound is generated with the help of a device called sonicator which is a AC electric signal generator.it produces a AC electric electric signal which is applied across a piezoelectric crystal that is transducer. This crystal undergoes rhythmic deformation due to electric current, producing ultrasonic vibrations.in the process of ultrasonic wave generation, electric energy is converted into mechanical energy in the form of oscillations, which generate acoustic waves.

APPLICATIONS:

- 1) Sonophoresis technique is very useful in the treatment of damaged skin.
- 2) Also useful in hormone delivery.
- 3) An surgery, it helps in dissection, connection, built-up and treatment of biological tissue.
- 4) It is also useful when low frequency ultrasonic gene delivery was done.
- 5) Sonophoresis is also very useful in the drug enhancement in granulomas and tumors. most cancer therapy drugs act intracellularly.
- 6) Ultrasound used for calcific tendinitis of the shoulder.
- 7) Ultrasound helps in treating tennis elbow and tendon problem.

CONCLUSION:

Proper choice of ultrasound parameters including ultrasound energy dose, frequency, intensity, pulse length and distance of transducer from the skin is critical for efficient sonophoresis. Various studies have indicated that application of ultrasound under condition used for sonophoresis does not cause any permanent damage to the skin. Ultrasound also works synergistically with several other enhancers including chemicals and iontophoresis.

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