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MICRONEEDLES – AN ADVANCED DRUG DELIVERY SYSTEM

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Abstract: Microneedles (MNs) is a transdermal drug delivery system and an advanced method of drug delivery in which drug can be delivered through the skin for systemic distribution (absorption). The aim of current study is to spread the awareness of Microneedles and to optimize the transdermal drug delivery with painless procedure. For the same purpose, a survey based study has been conducted on a sample size of 75 healthy volunteers and it is carried out in different hospitals and clinics to collect views about this drug delivery system. On the basis of their knowledge, it is concluded that Micro needles will provide increased patient compliance and increased absorption by 1000 times with prevention of skin damage. However, the popularity of Micro needles in this area is fair but advancement and experts required in this delivery of active pharmaceutical to achieve the best patient compliance and painless drug delivery with dose reduction and less puncture to skin damage. We hope that this advanced technique will be applicable in near future and will give its maximum effectiveness.

Keywords: Micro needles; transdermal drug delivery; painless procedure

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INTRODUCTION

Microneedles (MNs) is a transdermal drug delivery system and an advanced method of drug delivery in which drug can be delivered through the skin for systemic distribution (absorption). [1] The micropores (Micron-scale Channels) that are produced by insertion of micron sized needles have shown to increase the skin permeability and a pathway for the transdermal drug delivery. [2] Micro needles also provide controlled drug delivery across the skin and reduce the needle insertion pain and tissue trauma. [3]

The skin consists of Epidermis; Dermis and Hypodermis. The middle layer "Dermis" contains a nerve and vascular network and also the nerve endings. Microneedles shown to penetrate into the skin without causing damage to the nerve endings and cross intact Stratum corneum which acts as rigorous barrier of epidermis. Therefore, stimulus caused by insertion of Microneedles is so weak into the skin due to which drug is delivered painlessly. [4]

The application of Microneedles is fairly simple. First the area is cleaned and then patch is applied on skin in a stamping motion. The patch consists of micro-projection of needles that do not reach to the lower part of the skin. So, stimuli of the short needles are so weak and drug is administered painlessly. [5] Micro needles are being used to deliver a numbers of different macromolecular drugs, bio-therapeutics and vaccines such as insulin, human growth hormones, immunological proteins and peptides. [6] Micro needles also ensure painless technique and do not puncture the nerve endings due to which reduce the chances of pain, infection and injury on skin. They can be used for sampling of biological fluids for diagnostic such as blood glucose measurement and delivery of insulin or other drugs as needed. [7] Drug also delivered by using Microneedles in children more conveniently due to its painless procedure and smaller doses as children are needles-phobes and Microneedles are very short. [8]

A number of techniques have been available to deliver the drugs by using Microneedles for transdermal drug delivery includes;

1. POKE WITH PATCH APPROACH: - This method involves the insertion (POKE) of solid Microneedles into the skin by the application of drug patch to the treated skin surface and drug transport can be occur by passive diffusion. It is used to deliver the insulin by insertion. The needles were made up of silicon waters and medicated patch. This approach is known as poke and patch approach and this technique is also used to measure the glucose level.

2. COAT AND POKE APPROACH: - In this method, first coat the solid needles with drug solution and then inserted into the skin and drug will release by dissolution. Entire drug will be delivered after coated over the surface of needles. This approach used to deliver the protein vaccine.

3. POKE AND RELEASE APPROACH**: -** In which Micro needles were made from polymers and polysaccharides and followed by insertion into the skin for a controlled delivery and modulated the release of drug.

4. POKE AND FLOW APPROACH:- In this approach, the large amount of drug is administered through the fabrication of hollow Microneedles through which drug flow is occurred. [9]

The products related Micro needles that are now sold around the world are; BD SOLUVIA ™ (It is a preferable Microinjection system for the intradermal accurate delivery of drugs and vaccines). MTS ROLLER ™ (It is a Micro needles therapy system used in the treatment of anti-aging, scars and hairloss in men and women. It stimulates the collagen and elastin production and thickens the skin due to which wrinkles removes).

DERMAROLLER ® (It is a device used for cosmetic purposes and applied to enhance the skin clearing by glycerol and increased skin permeability by chondroitin sulfate). MICRO HYALA ® (It is used to treat wrinkles. It act as a patch covered with dissolving Microneedles hyaluronic acid which is released in the skin).LITE CLEAR® (It is used to control the acne). [10]

Figure 1: Micro needles – An Advanced Drug Delivery System

Aim of Study:-

The aim of current study is to spread the awareness of Microneedles and to optimize the transdermal drug delivery of macro-molecules, supra-molecular complexes as well as micro-particles with painless procedure.

Methodology:

1. **Sample Size:-** In this study, the sample size of 75 healthy volunteers has been taken. For the same purpose, a survey based study has been conducted by a designed questionnaire and it is carried out in different hospitals and clinics to collect views about this drug delivery system.

2. **Population Categories:-**Seventy five graduate, educated doctors and pharmacists of different hospitals in Karachi participated in this study aged between 22 to 43 years and 40 of the participants are male (53.33%) and 35 (46.66%) are female.

3. Parameters:-

a) How much health professionals have idea about Microneedles?

b) Microneedles are how much applicable?

c) Microneedles are more convenient than other methods?

d) What is ratio of using Microneedles in general population?

e) Painless during delivery as compare to hypodermic syringes?

f) Transportation of macro-molecules, supra-molecular complexes as well as micro-particles?

g) Increased patient compliance?

h) Increased absorption by 1000 times with prevention from skin damage?

RESULTS AND DISCUSSIONS:

The purpose of this study was to determine the effectiveness of Microneedles regarding painless procedure as it is the advanced transdermal drug delivery system in which delivery of pharmaceutical ingredient is painless as these Microneedles do not damage the nerve endings. We conducted an experiment using 75 graduate doctors and pharmacists of different hospitals from Karachi. We evaluate the views of different doctors and pharmacists on the basis of the questionnaire that we prepared to accomplish this task. On the results of the questionnaire, we compiled the views according to our different parameters that are shown in this study's methodology. Almost all of the health professionals know about this advanced transdermal drug delivery system. But this surgical procedure requires experts and this is the new technique therefore not applicable in Karachi but we have good hopes for its application in future.

According to our survey based study, results have shown that it is more convenient method which is true but the ratio of using Microneedles in general population is zero as in Pakistan, there is not much application due to its advanced nature of technique. Most of the health

professionals agreed that Microneedles is the painless drug delivery as compare to hypodermic syringes and it is responsible to deliver macro-molecules, supra-molecular complexes as well as micro-particles.

On the basis of their knowledge, they concluded that Microneedles will provide increase patient compliance and increase absorption by 1000 times with prevention of skin damage. However, the popularity of Microneedles in this area is fair but advancement and experts required in this delivery of active pharmaceutical to achieve the best patient compliance and painless drug delivery with dose reduction and less puncture to skin damage. We hope that this advanced technique will be applicable in near future and will give its maximum effectiveness.

REFERENCE:

1. Daniel P. Wermeling, Stan L. Banks, David A. Hudson, Harvinder S. Gill, Jyoti Gupta, Mark R. Prausnitz, Audra L. Stinchcomb "Microneedles permit transdermal delivery of a skin-impermeant medication to humans", vol. 105 no. 6 > 2058–2063, doi: 10.1073/pnas.0710355105.

2. Nicole K. Brogden, Priyanka Ghosh, Lucia Hardi, Leslie J. Crofford, Audra L. Stinchcomb "Development of in vivo impedance spectroscopy techniques for measurement of micropore formation following microneedle insertion", Journal of Pharmaceutical Sciences Volume 102, Issue 6, pages 1948–1956, June 2013.

3. Pierre MB, Rossetti FC "Microneedle-based drug delivery systems for transdermal route", Curr Drug Targets. 2014 Mar; 15(3):281-91.

4. Niclas Roxhed "A Fully Integrated Microneedle-based Transdermal Drug Delivery System", ISBN 978-91-7178-751-4, ISSN 1653-5146, TRITA-EE 2007:046.

5. Andrew Nusca "3M's new drug delivery system: disposable microneedles".

6. Yeu-Chun Kim, Jung-Hwan Park, and Mark R. Prausnitz "Microneedles for drug and vaccine delivery", Adv Drug Deliv Rev. Nov 2012; 64(14): 1547–1568.

7. Yadav, Jaydeep D.; Vaidya, Kumar A.; Kulkarni, Priyanka R.; Raut, Rajvaibhav A. "Microneedles: Promising Technique For Transdermal Drug", International Journal of Pharma and Bio Sciences, Vol 2 issue 1 / jan-march 2011.

8. Ryan F. Donnelly, Thakur Raghu Raj Singh, Desmond I. J. Morrow, A. David Woolfson "Microneedle-mediated Transdermal and Intradermal Drug Delivery", ISBN: 978-0-470-65489-7, 216 pages, February 2012, Wiley-Blackwell.

9. Jyoti Gupta "Microneedles For Transdermal Drug Delivery In Human Subjects", Georgia Institute of Technology August 2009.

10. Yeu-Chun Kim, Jung-Hwan Park, Mark R. Prausnitz "Microneedles for drug and vaccine delivery", Advanced Drug Delivery Reviews 64 (2012) 1547–1568.