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REVIEW ARTICLE

LASER MICROPORATION FOR THE DELIVERY OF DRUGS INTO AND ACROSS THE SKIN

Sachin Dubey*

Department of Pharmaceutical Technology, School of Pharmaceutical Sciences, University of Geneva and University of Lausanne,Geneva, Switzerland

**E-mails*: dubeysk@gmail.com, Sachin.Dubey@unige.ch
Tel.: +41 22 379 3373, Fax: +41 22 379 3360.

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Stratum corneum is the outermost layer of the skin and is the biggest barrier for the permeation of drugs. By applying external energy stratum corneum (SC) can be ablated such that it enhances molecular transport. Creating micro channels using laser power is one of the latest and most promising development. Irradiating skin with laser of particular frequency results in excitation of specific molecules (most often water molecules) in the skin. The super heating of water reciprocates in micropore formation. The technique is relatively new, but holds promises for future. This review provides an overview of laser poration and its application in transdermal drug delivery.

Key words: Laser microporation, Transdermal drug delivery, Stratum coneum, Skin.

INTRODUCTION

Transdermal drug delivery is an established delivery route with a series of advantages, like controlled delivery, patient friendly, avoid GIT and first pass metabolism etc (Mohabe *et al* 2011; Talegaonkar *et al* 2011). Even though there has been much interest in transdermal drug delivery, only a limited number of molecules have successfully made it to market. This is mainly because only few of them have ideal physicochemical properties such that they can be delivered across the skin at therapeutic concentrations. To overcome this a series of techniques have been developed such that more number of molecules can be delivered; this is mainly achieved by applying energy either for breaching the barrier function of stratum corneum or by active transportation of drug molecules (for example iontophoresis) (Barry, 2004; Kalia *et al* 2004; Scheuplein and Blank, 1971). Former includes techniques which creates micropores either by mechanical force (as in microneedles), thermal energy, radio energy or by using laser power. Lasers emit monochromatic light in parallel rays (De Felice, 2010). When skin is irradiated with laser, a small part of laser energy is absorbed which can be converted to heat. The most widely used laser for transdermal application is Er:YAG laser, which emits light at 2940 nm, corresponding to the excitation wavelength of water. As the laser strikes skin, it excites water molecules and results in explosive evaporation which further translates in the pores formation (Bass, 1998; Walsh *et al* 1988; 1989; Kalia *et al* 2008).

Parameters affecting laser microporation

Excitation of specific skin constituents is important to create pores. These pores should be controlled such as to minimize tissue damage. Infrared and UV based lasers are used for this purpose. In early 90's, UV based lasers were used for drug delivery applications but soon it was known that they harm surrounding tissues as well; they cause erythema, hyperpigmentation and cutaneous cancers. Although IR wavelength lasers can cause retinal damage, their power can be used constructively for transdermal drug delivery applications. Infrared (IR) laser power can be generated by using CO_2 and Er:YAG lasers (Lee *et al* 2002; Gomez *et al* 2011). Most commonly used lasers for medical and drug