Skin pretreatment with an Er:YAG laser promotes the transdermal delivery of three narcotic analgesics.

Lee WR, Shen SC, Fang CL, Liu CR, and Fang JY

Abstract

Because of their low oral bioavailabilities and short half-lives, it may be more feasible to administer narcotic analgesics via the skin. However, this delivery method is limited by the low permeability of the stratum corneum (SC). The aim of this study was to enhance the transdermal delivery of three narcotic drugs, including morphine, nalbuphine, and buprenorphine, with an erbium:yttrium-aluminum-garnet (Er:YAG) laser pretreatment. In an in vitro pig skin permeation experiment, Er:YAG laser pretreatment of the skin produced a 10~35-fold enhancement in drug permeation that was dependent on the laser fluence and the narcotic analgesic used. The permeation of morphine and nalbuphine showed higher enhancement with Er:YAG laser treatment as compared to that of buprenorphine. This may have been due to the higher lipophilicity and molecular mass of buprenorphine than the other two narcotic drugs. A photomechanical wave was generated by filtering laser radiation through a polystyrene target. The experimental results showed that a single photomechanical wave was sufficient to enhance morphine permeation by sevenfold. This enhancement was significantly lower than that produced by direct laser irradiation, indicating the predominant mechanism of SC ablation by the Er:YAG laser for transdermal drug delivery.