Transdermal delivery of nalbuphine and nalbuphine ppivalate from hydrogels by passive diffusion and iontophoresis

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Abstract

The objective of this study was to evaluate the In vitro transdermal permeation of nalbuphine hydrochloride (CAS 23277-43-2) (NA) and nalpuphine pivalate (NAP), a novel prodrug of NA, from different hydrogel formulations under passive diffusion as well as lontophoresis. Various concentrations of polymers including polyvinylpyrrolidone (PVP) and hydroxypropyl cellulose (HPC) were used in the hydrogel formulations. The passive permeation rate of NA was affected by the polymer concentrations, which can be attributed to different viscosities of the hydrated formulations; whereas the passive permeation rate of NAP was not influenced by the various polymer concentrations. Iontophoresis significantly increased the permeation rates of NA and NAP from various hydrogel formulations through skin; the enhancement ratios were higher for NA in all the formulations studied. The iontophoretic permeation rates of NA were slightly decreased by the incorporation of polymers; however, the transdermal flux and membrane potential were independent of polymer concentrations for both NA and NAP, demonstrating that the polymer concentrations in the hydrogel formulations did not have significant effects on the iontophoretic permeation of NA and NAP.