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Combined Effect of Vesicular System and Iontophoresis on Skin Permeation Enhancement of an Analgesic Drug

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Abstract : The major challenge faced by formulation scientists in transdermal drug delivery system is to overcome the inherent barriers related to skin permeation. The stratum corneum layer of the skin is working as the rate limiting step in transdermal transport and reduce drug permeation through skin. Many approaches have been used to enhance the penetration of drugs through this layer of the skin. The purpose of this study is to investigate the development and evaluation of a combined approach of drug carriers and iontophoresis as a vehicle to improve skin permeation of an analgesic drug. Iontophoresis is a non-invasive technique for transporting charged molecules into and through tissues by a mild electric field. It has been shown to effectively deliver a variety of drugs across the skin to the underlying tissue. In addition to the enhanced continuous transport, iontophoresis allows dose titration by adjusting the electric field, which makes personalized dosing feasible. Drug carrier could modify the physicochemical properties of the encapsulated molecule and offer a means to facilitate the percutaneous delivery of difficult-to-uptake substances. Recently, there are some reports about using liposomes, microemulsions and polymeric nanoparticles as vehicles for iontophoretic drug delivery. Niosomes, the nonionic surfactant-based vesicles that are essentially similar in properties to liposomes have been proposed as an alternative to liposomes. Niosomes are more stable and free from other shortcoming of liposomes. Recently, the transdermal delivery of certain drugs using niosomes has been envisaged and niosomes have proved to be superior transdermal nanocarriers. Proniosomes overcome some of the physical stability related problems of niosomes. The proniosomal structure was liquid crystalline-compact niosomes hybrid which could be converted into niosomes upon hydration. The combined use of drug carriers and iontophoresis could offer many additional benefits. The system was evaluated for Encapsulation Efficiency, vesicle size, zeta potential, Transmission Electron Microscopy (TEM), DSC, in-vitro release, ex-vivo permeation across skin and rate of hydration. The use of proniosomal gel as a vehicle for the transdermal iontophoretic delivery was evaluated in-vitro. The characteristics of the applied electric current, such as density, type, frequency, and on/off interval ratio were observed. The study confirms the synergistic effect of proniosomes and iontophoresis in improving the transdermal permeation profile of selected analgesic drug. It is concluded that proniosomal gel can be used as a vehicle for transdermal iontophoretic drug delivery under suitable electric conditions.

Keywords : iontophoresis, niosomes, permeation enhancement, transdermal delivery
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