Enhancement of skin penetration of lidocaine by an iontophoresis device in *ex vivo* human skin and Strat-M® membrane

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BACKGROUND

Skin constitutes an excellent barrier for the transdermal delivery of hydrophilic or high molecular weight drugs. Low efficacy demonstrated in clinical trials for some topical drugs is mainly due to low skin penetration ability related to the efficient barrier properties of *stratum corneum* (SC). In order to overcome the SC, different chemical and physical methodologies have been investigated to enhance skin penetration. Among the physical methods, one presents the application of an electric current across the skin that drives ion flow through the skin and induces an increase of skin penetration. The aim of this work was to evaluate the effect of electric current on lidocaine delivery on *ex vivo* human skin and on Strat-M® membrane using an iontophoresis device developed by Feeligreen.

METHODS

Diffusion cells were specifically manufactured for the purpose of the study (Figure 1). Strat-M® membrane and *ex vivo* human skin samples were mounted on diffusion cells and a disc of gel containing 5% lidocaine was applied on the surface of samples. The iontophoresis device was applied over the gel (Figure 2) and a constant electric current of 1.48 mA was delivered (treated groups) or not (control group). Skin and membrane samples were maintained in cell incubator set at 37°C and 5% CO_2 for 3 hours under gentle shaking. Each condition was tested in duplicate. Concentrations of lidocaine in skin and receptor liquid samples were measured using an HPLC method with UV detection.

Figure 1: Diffusion cells specifically designed for this study

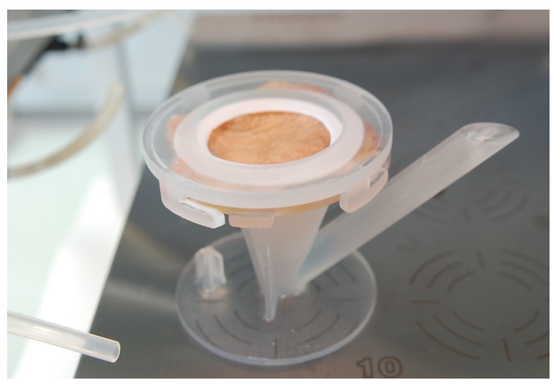
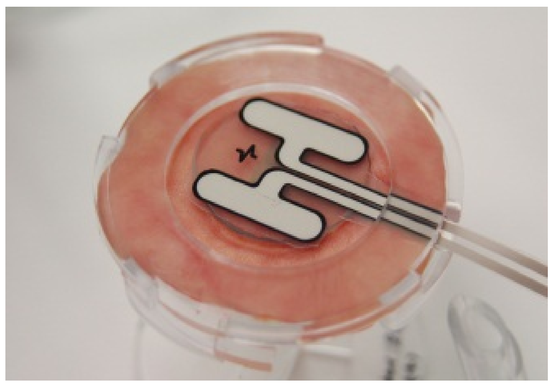


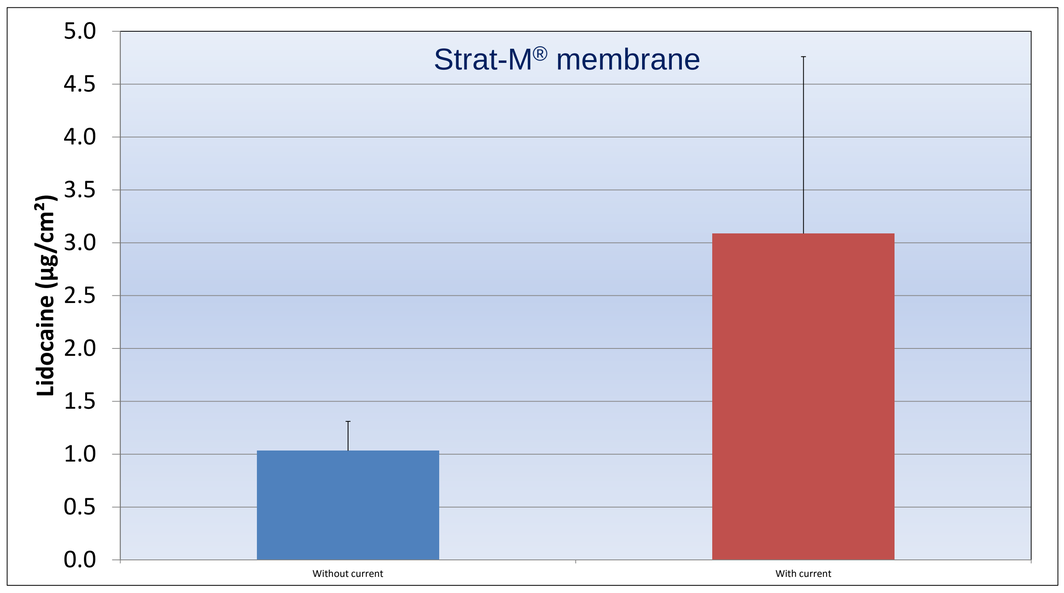
Figure 2: Iontophoresis device applied on the surface of the skin and Strat-M® membrane



RESULTS

Figure 3: Effect of electric current on absorption of Lidocaine.
Data represent mean +/- SEM (n = 2)
A - Strat-M® membrane (receptor liquid). B - Ex vivo human skin

3A



3B

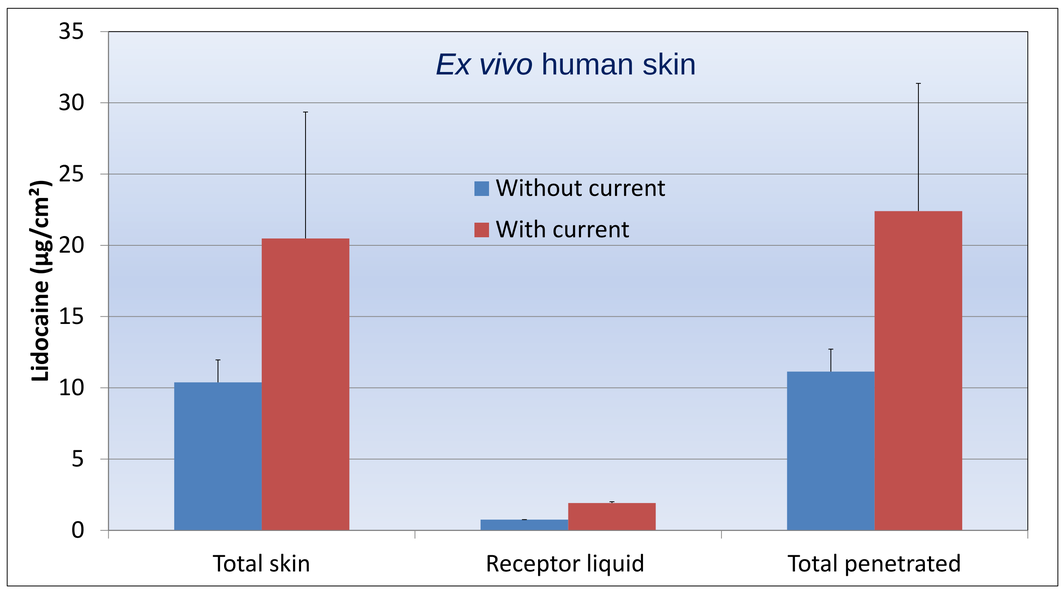
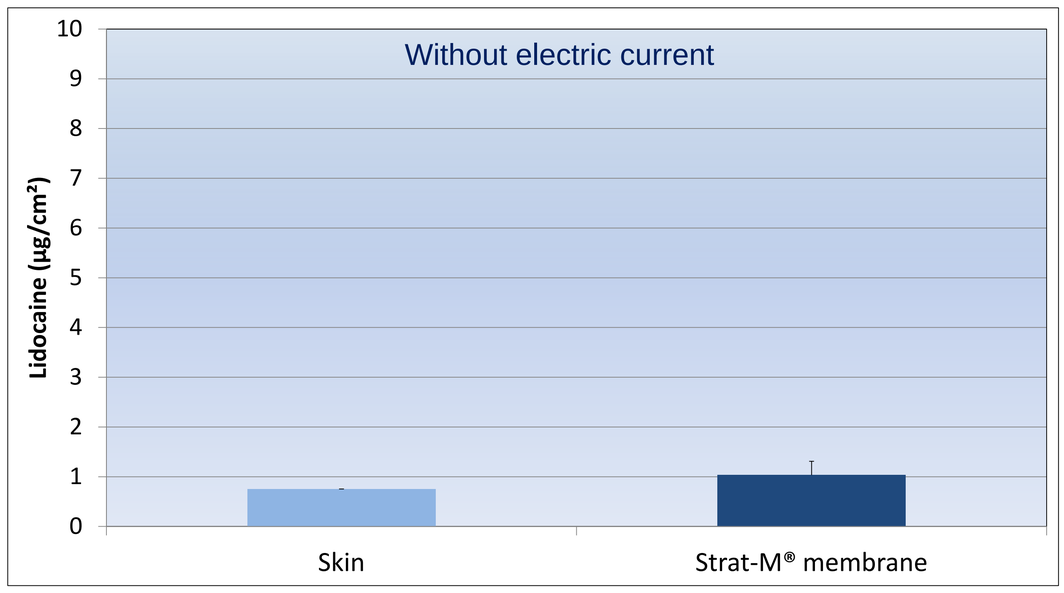
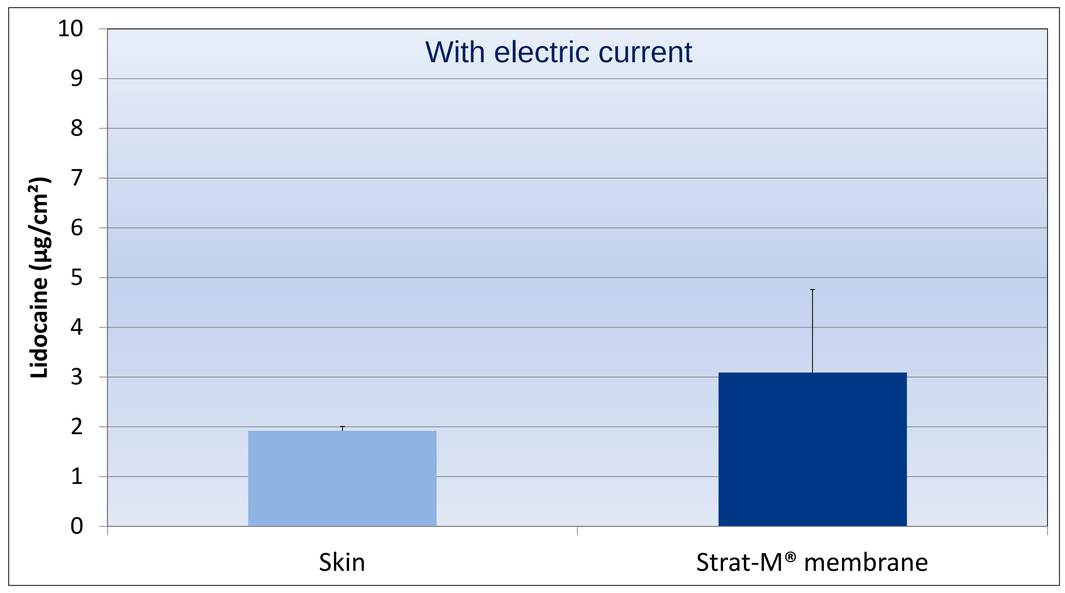


Figure 4: Comparison of lidocaine absorption in receptor liquid on skin and Strat-M® membrane. Data represent mean +/- SEM (n = 2)
A - Without electric current. B - With electric current

4A



4B



- Absorption of lidocaine (receptor liquid) was almost similar in both Strat-M® membrane and *ex vivo* human skin whatever the condition tested.
- Treatment of Strat-M® membrane and human skin by iontophoresis device increases absorption of lidocaine (receptor liquid) by 3-fold. In addition, iontophoresis increases penetration of lidocaine in the skin by 2-fold.

CONCLUSION

The iontophoresis device developed by Feeligreen can be suitable tool for clinical and preclinical use in order to enhance dermal delivery of test products.

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