The ablative fractional coagulation zone influences skin fluorescence intensities of topically applied test molecules-An in vitro study with fluorescence microscopy and fluorescence confocal microscopy.


ABSTRACT

BACKGROUND:Ablative fractional laser (AFL) increases uptake of topically applied skin agents. The coagulation zone (CZ) surrounding vertically ablated channels may influence uptake of drugs.

OBJECTIVES:To investigate impact of CZ thickness on skin fluorescence intensities (FI) of a hydrophilic molecule by means of fluorescence microscopy (FM) and fluorescence confocal microscopy (FCM). Second, to compare FI of hydrophilic and lipophilic test molecules by FCM.

STUDY DESIGN/METHODS AND MATERIALS:Microchannels with CZ thicknesses of 0, 20, and 80?µm were generated by microneedles or AFL (10,600?nm). Channels were 700?µm deep and number of channels kept constant per skin area. After 4 hours of incubation, FI induced by sodium fluorescein (NAF, hydrophilic, logarithmic partition-coefficient (logP)\(\text{NAF} = -1.52\), MW\(\text{NAF} = 376.26\)) were quantified in both CZ and surrounding skin by FM (0-1,500?µm) and FCM (0-90?µm). FI of NAF and carboxyfluorescein (CAF, lipophilic, logP\(\text{CAF} = 2.9\), MW\(\text{CAF} = 376.32\)) were compared by FCM.

RESULTS:By FM, NAF-induced FI were higher in CZ than in surrounding skin (\(P<0.001\)). Highest NAF-FI were induced in skin pretreated with a thin CZ (CZ-20?µm), assessed by both FM and FCM and in particular, FI were higher than in skin pretreated with no CZ (CZ-0?µm) (FM P\(\text{CZ-0?µm} < 0.041\), FCM P\(\text{CZ-0?µm} < 0.012\)). Skin FI remained constant to a depth of 500?µm, which corresponded to approximate depth of microchannels (CZ-0?µm, CZ-20?µm, CZ-80?µm: 0-500?µm P\(\text{CZ-0?µm} = 0.107\)). In accordance with FM data, FCM showed higher FI within CZ than in surrounding skin, but gradually decreased to zero at a depth of 90?µm. NAF-FI were higher than CAF-FI (P\(\text{CAF-0?µm} = 0.036\)), and highest CAF-FI were induced by CZ-0?µm and CZ-20?µm compared to CZ-80?µm (P\(\text{CAF-0?µm} = 0.009\)).


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