Enhanced Uptake of 2% Salicylic Acid Following 1440-nm Non-ablative Fractional Diode Laser Treatment

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OBJECTIVE

- To quantify uptake of topical 2% salicylic acid after pretreatment with a 1440-nm non-ablative fractional diode laser with varying treatment densities

CONCLUSIONS

- In this ex vivo analysis of transdermal 2% salicylic acid uptake, low-power 1440-nm non-ablative fractional diode laser pretreatment with 320 MTZ/cm^2 resulted in greater retention within skin tissue samples compared to untreated controls and the 80-MTZ/cm^2 setting
- Retention enhancement following treatment with greater MTZ density did not appear to have an additive effect on overall uptake at 24 hours, supporting the argument that salicylic acid uptake may be predominantly transfollicular
- These results may guide the development of treatment protocols for clinical use of non-ablative fractional laser pretreatment to enhance uptake of salicylic acid–containing topicals

SYNOPSIS

- The structure of the stratum corneum can limit uptake and effectiveness of topical medications[1]; however, lasers can disrupt the stratum corneum and tight junctions in the epidermis, allowing for better topical penetration and absorption[2]
- Non-ablative fractional lasers have less effect on the stratum corneum, can minimize thermal side effects, and can shorten postprocedural downtime compared to ablative lasers[3,4]
- The relationship between topical uptake and laser device settings, such as wavelength, peak power, and spot density, must be quantified to optimize treatments

METHODS

- Excised human abdominal skin tissue samples of 500-µm thickness were pretreated with a low-power 1440-nm fractional diode laser (Clear + Brilliant® laser system; Solta Medical, Bothell, WA) using either 80 or 320 microscopic treatment zones (MTZ)/cm^2, or received no laser pretreatment (Table 1)

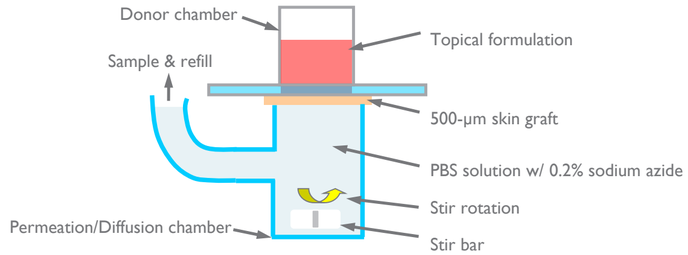
Table 1. Experimental Parameters

Parameter	Setting	
Device wavelength, nm	1440	1440
Spot density, MTZ/cm^2	80	320
Peak power, W	1.2	3
Spot size, µm	130	130
Pulse energy, mJ	9	9

MTZ, microscopic treatment zones.

- Following laser pretreatment, 2% salicylic acid was applied, and uptake was determined at various time points up to 24 hours after application (Figure 1)

Figure 1. Study design for testing uptake of topicals on skin tissue.



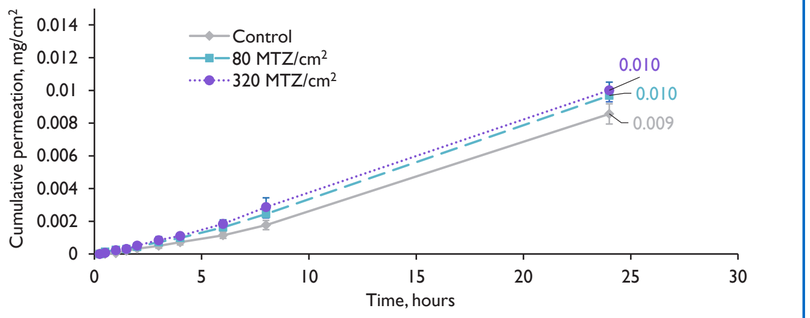
PBS, phosphate-buffered saline.

- Samples were filtered and analyzed using high-performance liquid chromatography to obtain permeation and retention for laser-treated samples and untreated controls
- Total uptake was calculated as the sum of the normalized cumulative permeation and retention in each sample
- Average total uptake was compared between laser-treated samples and untreated controls to determine the uptake enhancement ratio

RESULTS

- Cumulative permeation of 2% salicylic acid at 24 hours posttreatment was similar for both 1440-nm pretreatments (80 and 320 MTZ/cm^2; both 0.01 mg/cm^2) and untreated control (0.009 mg/cm^2; Figure 2)

Figure 2. Cumulative permeation of 2% salicylic acid through 24 hours after 1440-nm laser pretreatment.



Values are mean ± standard deviation. MTZ, microscopic treatment zones.

- Retention of 2% salicylic acid was ~9 times greater with 320-MTZ/cm^2 pretreatment compared to both 80-MTZ/cm^2 pretreatment and untreated control (Table 2)

Table 2. Enhancement of 2% Salicylic Acid Retention

	80 MTZ/cm^2	320 MTZ/cm^2
Control	1.06 ± 0.40 x	9.31 ± 3.96 x
80 MTZ/cm^2	—	8.74 ± 3.60 x

MTZ, microscopic treatment zones.

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