Quantifying Uptake of Topical 4% Hydroquinone After 1440-nm and 1927-nm Non-ablative Fractional Diode Laser Treatment

SYNOPSIS

- Non-ablative fractional diode laser pretreatment can enhance transdermal delivery and uptake of topicals and minimize thermal side effects that are more typical of ablative laser therapy.
- Fractionation can create microscopic treatment zones that spare surrounding tissue and further minimize postprocedural downtime.
- Clinical practice may be improved by understanding the relationship between topical uptake and energy-device settings, such as wavelength, peak power, and spot density.

METHODS

- Human donor skin tissue samples of 500-µm thickness were pretreated with a 1440-nm or 1927-nm laser (Clear + Brilliant laser system; Solta Medical, Bothell, WA), or received no pretreatment (Table 1).
- Following laser pretreatment, an in-house 4% hydroquinone serum (hydrophilic formulation) was applied, and permeation was measured up to 24 hours after application (Figure 1).
- Laser-treated skin and untreated controls were analyzed using high-performance liquid chromatography at various time points up to 24 hours after application to measure cumulative permeation and retention and to quantify uptake of 4% hydroquinone serum.
- Total uptake was calculated as the sum of the normalized cumulative permeation and retention in each sample.

RESULTS

- Pretreatment with the 1927-nm wavelength resulted in greater cumulative uptake of 4% hydroquinone serum compared to the 1440-nm wavelength and untreated control (Figure 2).
- The lower-power 1927-nm settings (0.6 and 1.0 W) were associated with 1.5- and 2.6-times greater uptake, respectively, compared to 1440-nm (1.2-W) pretreatment (Table 2).

CONCLUSIONS

- Non-ablative fractional diode laser pretreatment with the 1927-nm wavelength resulted in greater uptake of hydrophilic 4% hydroquinone serum compared to the 1440-nm wavelength, despite lower peak power and pulse energy settings.
- For the 1927-nm wavelength, higher power and pulse energy settings can cause greater superficial disruption to the stratum corneum and epidermis with subsequent uptake enhancement.
- The current analysis demonstrates the ability of the 1927-nm wavelength to produce more favorable uptake, especially at the higher power setting.
- Taken together, these results suggest that the 1927-nm wavelength may be used as laser pretreatment to enhance topical delivery, even for relatively hydrophilic topicals.

OBJECTIVE

- To quantify uptake of 4% hydroquinone serum using skin tissue pretreated with either a 1440-nm or 1927-nm non-ablative fractional diode laser.

REFERENCES


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