Experimental Comparative Study of the Minimal Erythema Dose and Internal Cost Among Three Narrow-Band Ultraviolet B (311 nm) Devices in Healthy Volunteers

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Abstract

Background: Narrow-band ultraviolet B (NB-UVB, 311 nm) phototherapy is widely recognized as an effective and safe treatment for chronic dermatologic conditions. Prior to initiating phototherapy, patients must undergo testing to determine the Minimal Erythema Dose (MED)—the smallest dose of UV radiation that produces perceptible erythema—to establish the appropriate initial treatment dose as a proportion of the MED (e.g., 35%, 50%, or 70%). NB-UVB devices used in clinical practice vary in configuration, operation, and testing complexity, which may influence procedure time, internal cost, and service efficiency.

Objective: To compare the average MED and internal testing costs among three NB-UVB phototherapy devices in healthy volunteers.

Methods: This experimental study (Randomized Controlled Trial) was conducted on 70 healthy volunteers aged 18 years or older, comprising both males and females with Fitzpatrick skin phototypes III–V. Participants had no history of photosensitivity disorders and discontinued any medications potentially affecting MED outcomes prior to testing. Each participant underwent MED testing on the back using three NB-UVB devices—DuaLight™ Model UV120-2, Daavlin 1 Series, and Waldmann UV7002B—in randomized order. Statistical analysis was performed using a mixed-effects model with Bonferroni post-hoc comparisons to assess mean differences between devices. All analyses were conducted using Stata version 14.1 (StataCorp, College Station, TX, USA). Statistical significance was determined at a two-sided $P < 0.05$.

Results: The mean MED differed significantly among the three devices ($p < 0.001$). The DuaLight™ Model UV120-2 produced significantly lower MED values than the Daavlin 1 Series and Waldmann UV7002B ($p < 0.001$). The internal testing cost and duration also differed significantly ($p < 0.001$), with the Daavlin 1 Series demonstrating shorter testing time and lower internal cost compared with the Waldmann UV7002B, while maintaining comparable MED values.

Conclusion: The Daavlin 1 Series was identified as the most efficient device for MED testing, requiring less time and lower internal cost without compromising accuracy. It is therefore recommended as the primary device for MED testing prior to NB-UVB phototherapy to enhance operational efficiency and optimize resource utilization in clinical practice.

Keywords: Minimal Erythema Dose (MED); Narrow-band UVB; Skin Phototype; Internal Cost