

Biophysical Measures of Skin Water Features: Variations among Anatomical Sites and Correlations between Parameters

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Purpose: Biophysical measures of stratum corneum (SC) hydration, dermal water content and transepidermal water loss (TEWL) are useful to assess skin properties and have implications for trans-dermal drug transport. Because skin properties differ among anatomical sites it is important to know the extent that these parameters vary among sites and the degree of correlation among the different parameters.

Methods: Healthy women (N=32, 33.7±14.0 yrs) participated. Measurements were done at 17 skin sites from forehead to foot. Capacitance of SC (1.25 MHz) and skin tissue dielectric constant (TDC) at 300 MHz were used to estimate effective SC hydration and skin tissue water (STW) to depths of 0.5, 1.5 and 2.5 mm. TEWL was measured using a closed chamber unventilated system. Measurements were done with subjects supine in a room at 25.0±1.0 °C and 44.5±2.2% relative humidity.

Results: STW as determined by TDC values decreased with increasing measurement depth except at sites with substantial sweat glands (e.g. hand palm and great toe) where TDC values increased with measurement depth. All parameters showed a large range among sites with maximum and minimum values (mean ± SD) shown in the table.

Parameter	Maximum		Minimum	
	Site	Value	Site	Value
SC	Forehead	71.6±29.4	Foot	9.6±8.4
TDC @ 0.5 mm	Forehead	39.6±7.2	Foot	27.0±4.4
TDC @ 1.5 mm	Forehead	36.9±2.7	Foot	26.6±2.6
TDC @ 2.5 mm	Hand Palm	39.1±4.6	Forearm	24.7±3.2
TEWL (g/m ² /hr)	Thumb Pulp	47.4±26.8	Forearm	8.24±4.9

SC values were positively correlated with TDC values (p<0.01) at 13 of 17 sites with the strongest correlation between TDC values at the 0.5 mm depth. Contrastingly, TEWL values correlated with TDC values at four sites (three on the hand).

Conclusions: These findings suggest that the substantial variation in the biophysical parameters among sites needs to be prudently considered in the design and interpretation of any comparative study involving different skin sites.