



The Validity of A Novel Low-Cost, App-Enabled Patient-Operated Device For Measuring Skin Barrier Function

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Background

- Transepidermal water loss (TEWL) and capacitance measure skin barrier permeability and hydration, respectively. TEWL and hydration are both abnormal in atopic dermatitis (AD) and frequently measured in AD clinical trials.¹
- Conventional devices used to measure TEWL and hydration are often costly, bulky and technically challenging.
- GPower GPSkin is capable of measuring both TEWL and skin hydration while being:
 - Low-cost
 - Compact
 - Designed for patient operation
 - Paired with a smartphone application

Purpose

This validation study investigated:

1. The correlation of GPSkin against current standards for TEWL and skin hydration, the Biox AquaFlux and Courage-Khazaka Corneometer, respectively.
2. The internal reliability of each device at a single institution.

Methods

- A prospective, cross-sectional validation study was conducted within the Dermatology Department of Oregon Health & Science University.

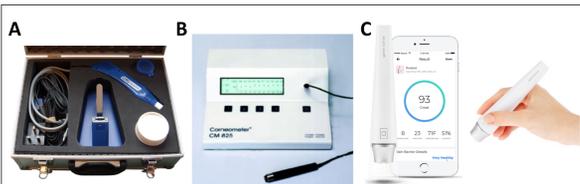


Figure 1. Study Devices. A) Biox AquaFlux AF200, B) Courage-Khazaka Corneometer CM 825 and C) GPower GPSkin.

- Study site: normal skin, volar forearm.²
- Macro- and microclimate controlled.²
 - Room: 20-22°C, 30-50% humidity
 - Participant: Acclimate for 10-15 minutes. No bathing or moisturizer for 6hrs prior to measurements.

Table 1. Data Collection Schematic³

Device	Measure	Trial 1 n=50	Trial 2 n=50
GPSkin	TEWL + Hydration	Participant	Participant + Investigator
AquaFlux	TEWL	Investigator	Investigator
Corneometer	Hydration	Investigator	Investigator

***Method modification:** Participants were provided minimal device instruction for trial 1. In trial 2, participants were educated on device use and used the “stick & click” method. The investigator also used the “stick & click” method.

Results & Analysis

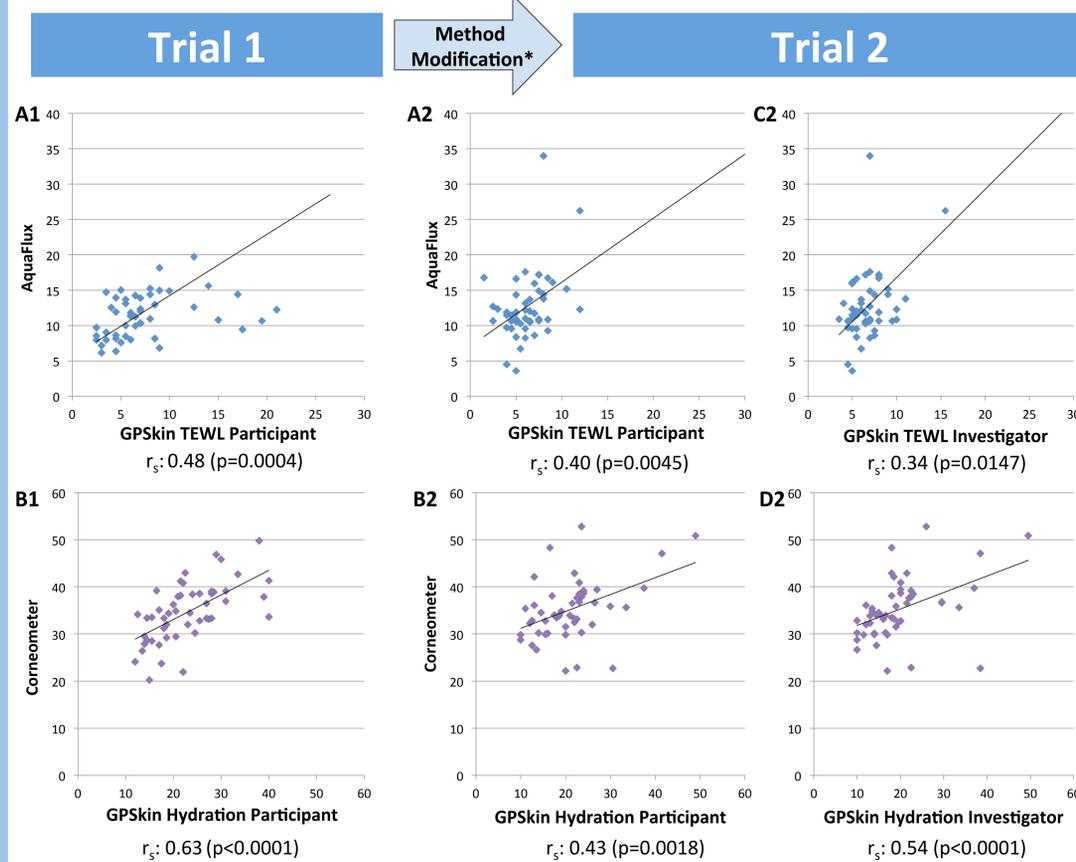


Figure 2. Spearman correlation coefficients (r_s) for GPSkin versus standards. GPSkin was tested against the AquaFlux to measure TEWL (top) and the Corneometer to measure hydration (bottom). In trial 1, only participants collected measurements with GPSkin (A1 and B1). In trial 2, both participants (A2 and B2) and investigator (C2 and D2) collected measurements with GPSkin. Trial 2 TEWL data consisted of 1 outlier data point not contained within the above graph (B).

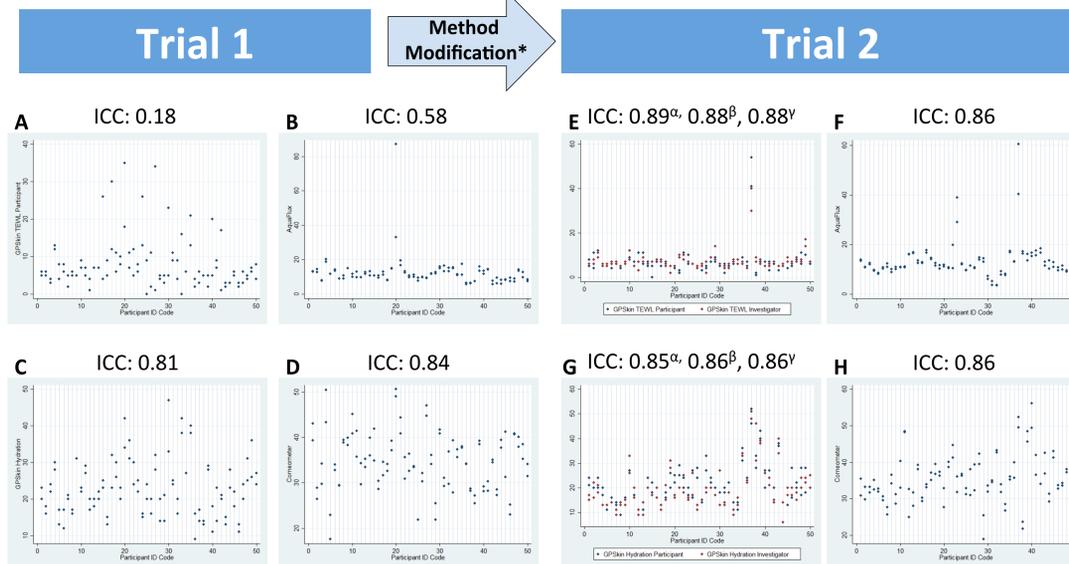


Figure 3. Intraclass Correlation Coefficients (ICCs) to Assess Device Test-Retest Reliability. ICCs were calculated for both TEWL (top) and hydration (bottom) measurements for GPSkin (A, C, E, G), the AquaFlux (B and F) and the Corneometer (D and H). TEWL ICCs improved from trial 1 to 2: GPSkin improved from 0.18 (A) to 0.89 in trial 2 (E) when comparing participant-collected measurements and the AquaFlux improved from 0.58 (B) to 0.86 (F). ICCs were calculated based on two-way mixed-effects models, with absolute agreement.

Table 3. ICC Interpretation⁵

ICC Value	<0.5	0.5-0.75	0.75-0.9	>0.9
Reliability	Poor	Moderate	Good	Excellent

Discussion

- GPSkin device primarily has “moderate” correlation with established standard measures for measuring TEWL and skin hydration.
- GPSkin demonstrated “good” reliability when participants were provided some additional minimal instructions on device use.
- There were no differences between participant and investigator test-retest reliability for GPSkin.
- Suggests patients will be able to collect measurements in reliable way.
- Device education is likely necessary for accurate measurement readings with GPSkin.

Conclusions

- GPower GPSkin barrier device may represent a useful patient-operated device to monitor skin barrier function with convenient at-home measurements.
- At-home skin barrier measurements may be used to monitor patient skin status, guide therapy decisions, and improve adherence.

Future Directions

- Repeat study in patients with atopic dermatitis
- Measure discriminative ability of device between known disease severity states
- Longitudinal device take-home study



References

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