

Topical delivery of skin-identical lipids reinforces the skin barrier to reduce skin susceptibility to irritants

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INTRODUCTION

- An altered composition of stratum corneum (SC) lipids, particularly ceramides, underpins the reduced skin barrier function of people with atopic dermatitis (AD) and other dry skin conditions.
- This leaves the skin more susceptible to irritant and allergen penetration, and colonization by pathogenic bacteria, which drive skin inflammation.
- An emollient containing skin-identical lipids and glycerine in a multivesicular emulsion (MVE+GL) was recently shown to improve lipid lamellae structure and barrier function when compared to a simple oil-in-water (O/W) emollient.¹
- The effects of MVE+GL on the skin barrier relative to a humectant-containing emollient have not been established yet.

1. Danby, S. G., et al. (2022) *Br J Dermatol* **186**(5): 875-886.

The BRaCE study

Aim: To determine whether MVE+GL can improve skin function and protect against irritation compared to a commonly prescribed oil-in-water emulsion containing glycerine (OW+G).

METHOD

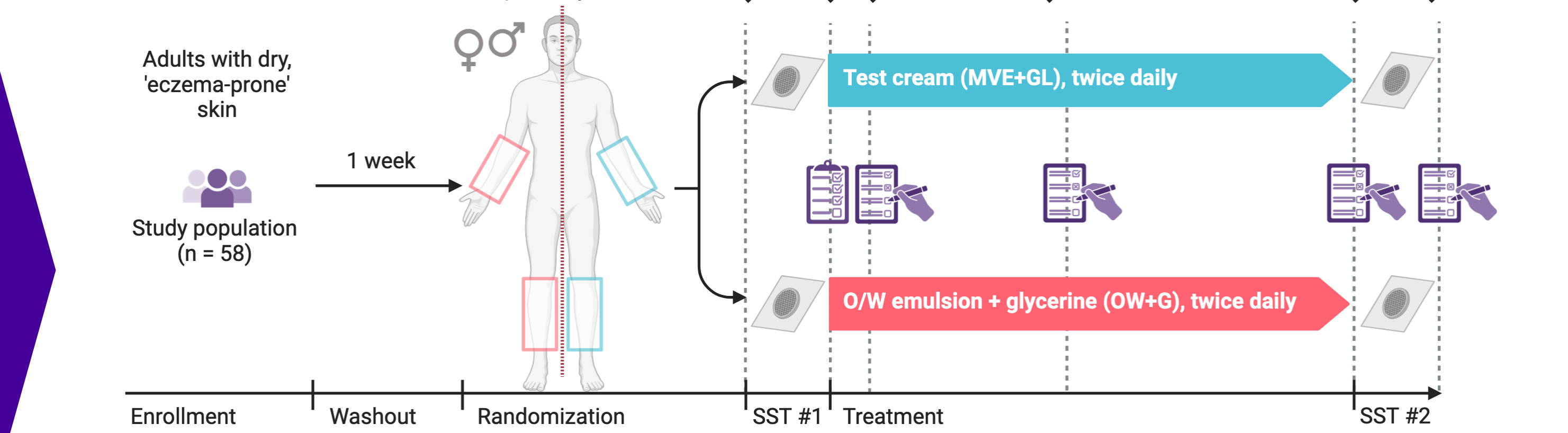


Fig 1: Fifty-eight adults with dry eczema-prone skin underwent 28 days treatment (twice daily application) with MVE+GL (CeraVe moisturizing cream, CeraVe, USA) on one forearm and leg and OW+G (Cetaben cream, Thornton & Ross, UK) on the other (randomized allocation). Skin properties were assessed before, during and after treatment. The composition and structure of skin lipids were assessed by shot-gun lipidomics on SC samples and *in vivo* ATR-FTIR spectroscopy respectively.

1. Topical application of skin-identical lipids successfully delivers key ceramides to the stratum corneum matrices

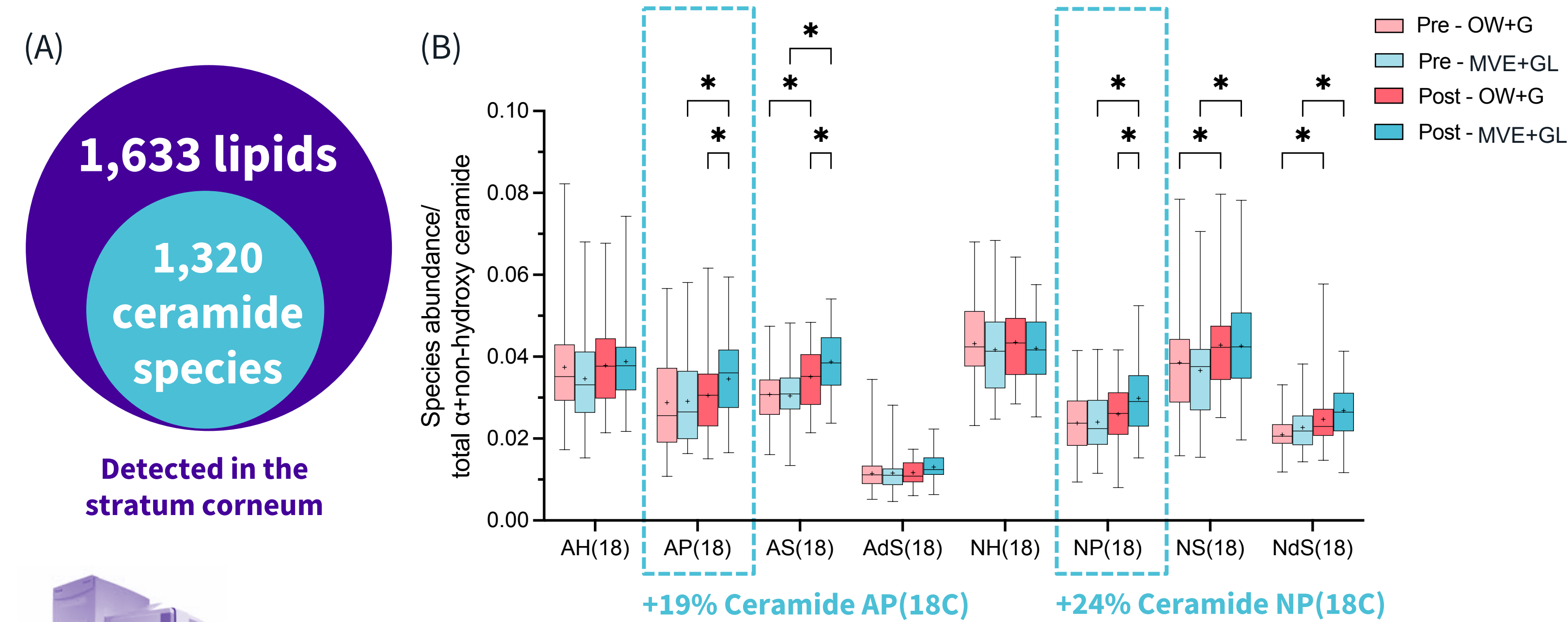


Fig 2: Shotgun lipidomic analysis detected 1,633 individual lipid species in the SC, of which 1,320 were ceramides (A). (B) The amounts of ceramides with 18 carbon sphingosine bases are plotted by class (AH, AP, AS, AdS, NH, NP, NS and NdS). After 4 weeks of treatment, there were significantly higher levels of AP(18C) and NP(18C) species in areas treated with MVE+GL compared to OW+G. Boxes are defined in Fig 5 legend. Asterisks indicate the results of pairwise testing (**p*<0.01).

2. Skin lipid replacement with MVE+GL strengthens the skin barrier in eczema-prone individuals

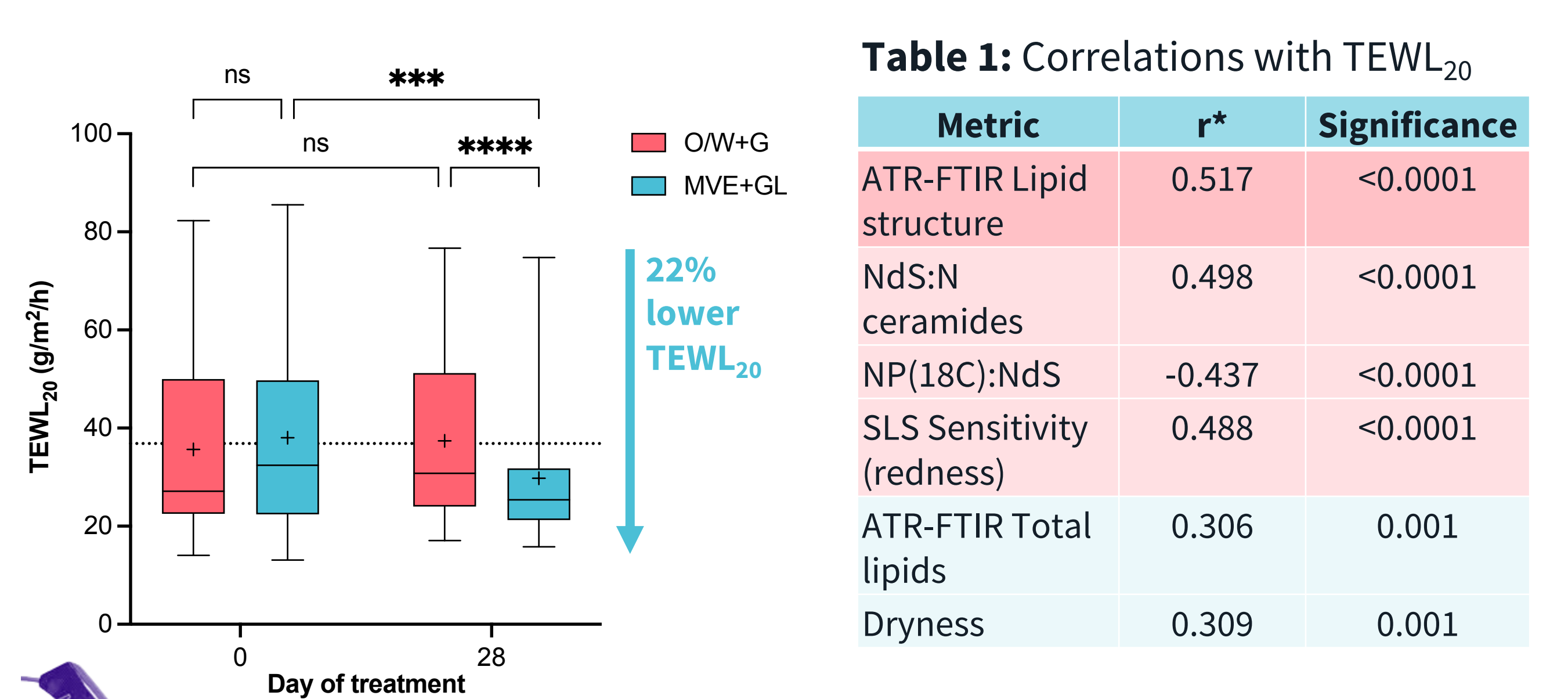


Table 1: Correlations with TEWL ₂₀		
Metric	r*	Significance
ATR-FTIR Lipid structure	0.517	<0.0001
NdS:N ceramides	0.498	<0.0001
NP(18C):NdS	-0.437	<0.0001
SLS Sensitivity (redness)	0.488	<0.0001
ATR-FTIR Total lipids	0.306	0.001
Dryness	0.309	0.001

Fig 3: Whilst OW+G did not affect skin barrier integrity (35.6±18.39 g/m²/h TEWL₂₀ before treatment versus 37.4±16.69 g/m²/h after treatment), MVE+GL significantly improved it (38.0±18.64 versus 29.8±13.47, before versus after, *p*=0.0019). The improvement was significantly associated with the rebalancing of ceramide levels and the enhanced lipid lamellae structure (see Table 1). Boxes are defined in Fig 5 legend. **r*, Pearson's.

3. Barrier strengthening with MVE+GL was associated with a significant reduction in irritation following challenge with a common household irritant

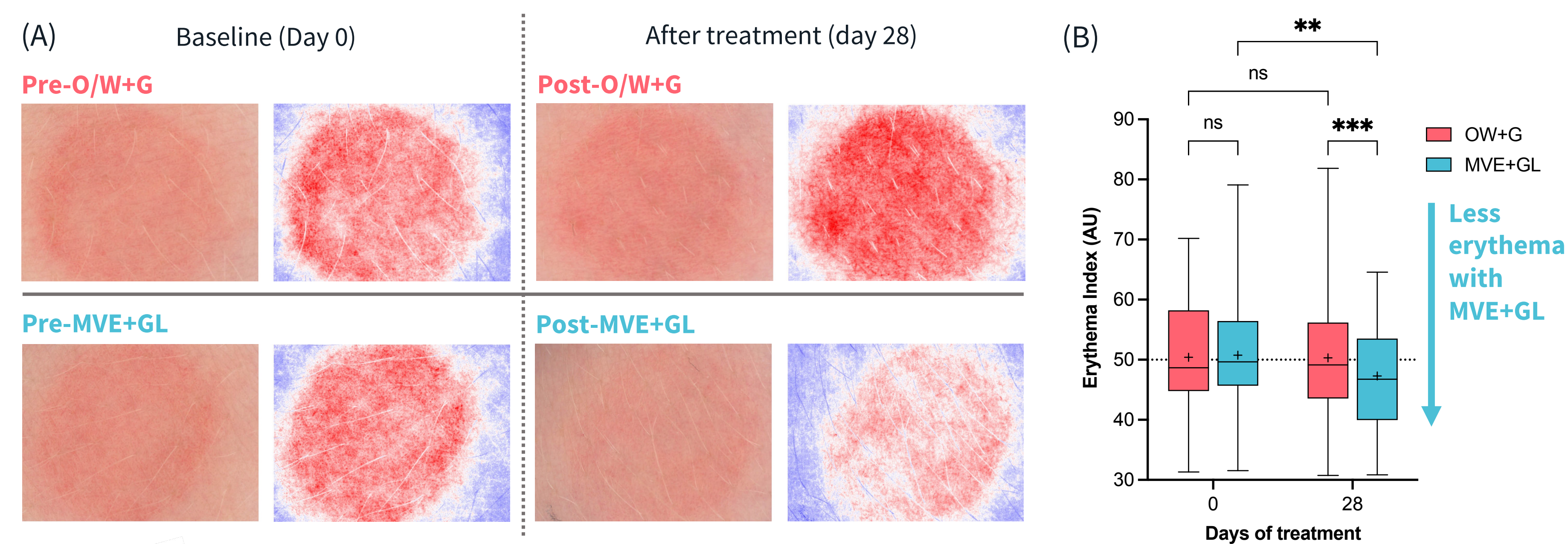


Fig 4: Skin sensitivity to sodium lauryl sulphate (SLS) challenge (1% applied under patches for 24h) before and after treatment. (A) Images post-SLS challenge from the same participant before and after treatment. Each image is shown 'as captured' (left) and with rendering to highlight erythema (right). (B) Mean erythema index from colour-calibrated images (*n* = 56); assessed using a mixed-effects analysis with a Fishers LSD post-test (ns, not significant; ***p*<0.01; ****p*<0.001). Boxes are defined in Fig 5 legend. The dotted line indicates the Day 0 mean.

4. MVE+GL more rapidly resolves skin dryness compared to O/W creams with glycerine

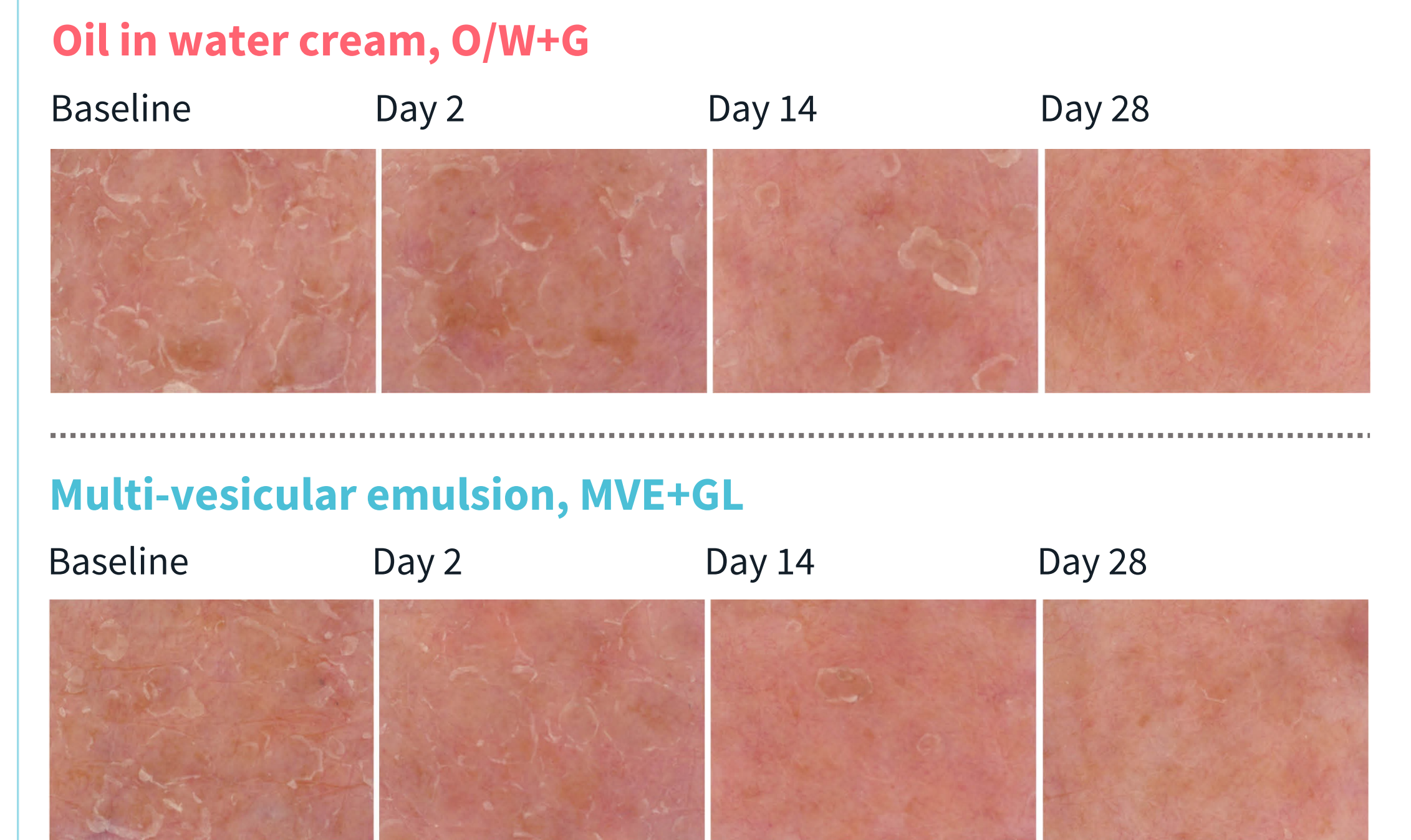
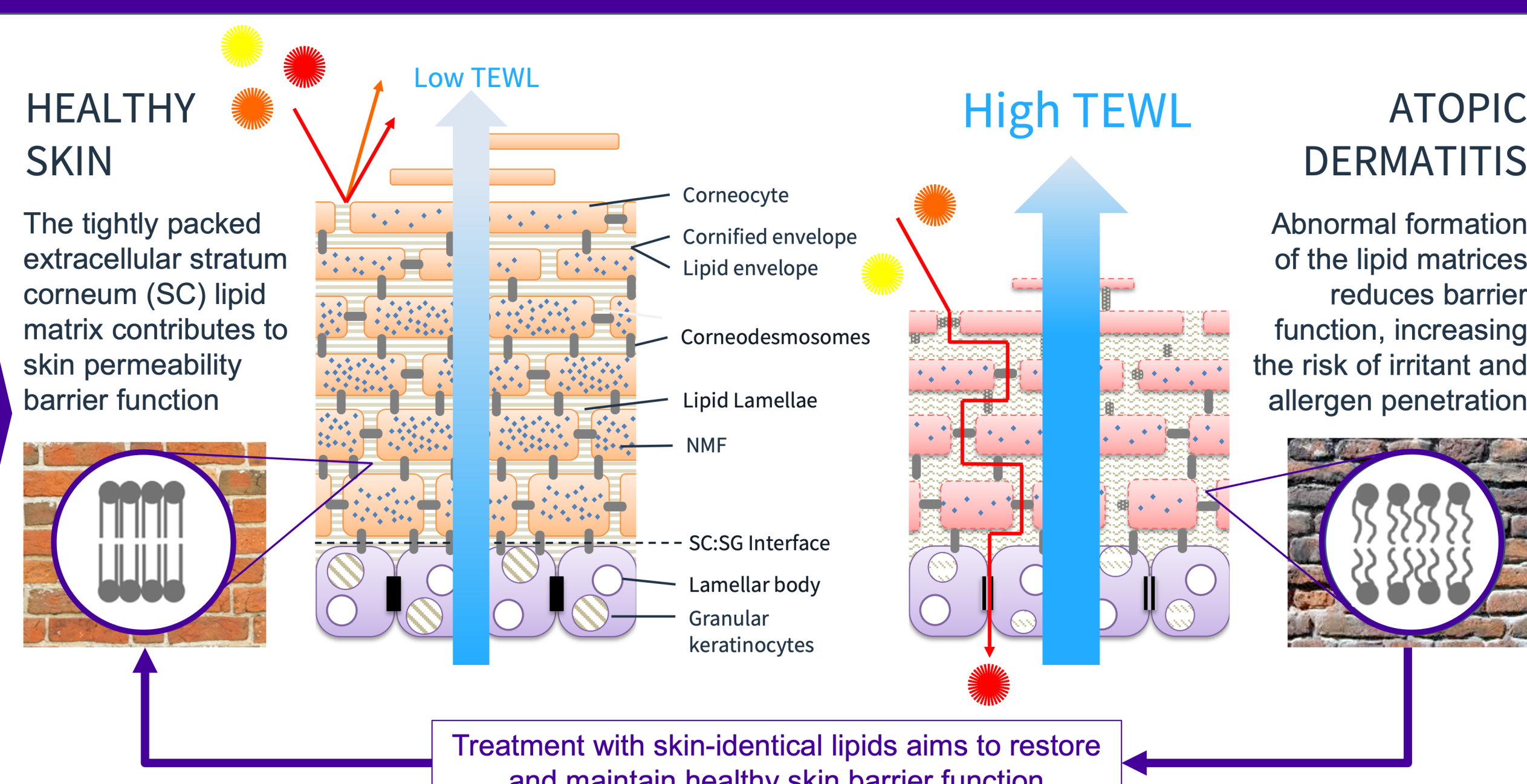


Fig 5: (Top) Images from the same participant showing visual skin surface dryness on the lower legs. (Bottom) SC water content on the volar forearm before and after treatment, measured *in vivo* using FTIR spectroscopy. A significant effect of treatment was found using a mixed-effects model (*n*=58). Boxes indicate the interquartile range, with the horizontal line showing the median, '+' the mean and whiskers the range. Asterisks indicate the results of pairwise testing (ns, not significant; *****p*<0.0001).

CONCLUSION

- Whilst a commonly used glycerin-containing O/W emollient was able to reduce skin dryness, it did not have an impact on the skin barrier, debunking the widely held belief that emollients inherently repair the skin barrier.
- MVE+GL is more appropriate than widely used O/W emulsions +/- glycerin for the maintenance of healthy skin by strengthening the skin barrier and protecting against key triggers of inflammation.



Thank you to our participants, & to Lipotype for performing the lipidomic quantification!

