

Measurements of trans-onychia water loss (TOWL) using Aquaflux.

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Transepidermal water loss (TEWL) – passage of water from the body through the skin into the outside environment - is a widely employed parameter to characterize the barrier function of human skin. Transonychia Water Loss (TOWL) – passage of water from the body through the *nail plate* into the outside environment – has also been measured, though to a far lesser degree, and correlations between TOWL and nail plate thickness, subject age, gender, disease state have been investigated. In vivo measurements have shown a lack of influence of nail plate thickness and gender on TOWL, but an influence of age and disease [1,2]. The TOWL values reported by the different researchers have been quite different. Some of the difference can be assigned to the different techniques of measurement. In general, the evaporimeters conventionally used for TEWL measurements have been used, with some modification. For example, Kronauer et al [2] used Plasticine to stick the probe to the fingernail. In our laboratories, we have used a specially designed measurement cap with the condenser-chamber Aquaflux to measure TOWL. The cap was designed by Biox (producer of Aquaflux) specifically for TOWL measurements.

The aim of the study was to develop a protocol for TOWL measurement using the Aquaflux and determine inter-day, inter-finger and inter-hand variabilities in TOWL in one subject, if any. Subsequently, the influence of nail varnish application and removal, filing and hydration of the nail plate on TOWL was determined.

It was found that the time allowed before instrument baseline calibration, interval between each measurement, and probe contact pressure on fingernail did influence TOWL readings. Significant inter-day, inter-finger and inter-hand differences in TOWL were found, which raises concerns. Filing the nail plate with a nail file increased TOWL, increase being related to number of filing strokes. Application of a cosmetic nail polish and of Teflon® Tuff™ (a ‘nail protector’ claimed to be a superior moisture barrier) reduced TOWL, as a function of the number of varnish coats applied. This shows that TOWL could be used as a parameter to compare nail products and as a quality control tool for the same product. Removal of the nail varnish with ethanol resulted in increase in TOWL to control values. Hydrating the nail plate (by fingernail immersion in water) increased TOWL, the extent of increase corresponding with duration of immersion, with a maximum being reached after 5 minutes immersion. Subsequently, TOWL decreased with time to control values, the time taken being directly related to duration of hydration.

Conclusion: A protocol for accurate and reproducible measurement of TOWL using the Aquaflux was developed. Inter-day, inter-finger and inter-hand differences in TOWL in one subject show the difficulties of using TOWL as a parameter, in disease, for example, and the need for careful controls. The study also shows that TOWL measurements do show promise as a tool in the testing of nail products.

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2. C Krönauer, M GFesser, J Ring, D Abeck, Acta Derm. Venereol., 2001, 81, 175-177.