Facial Skin Tissue Water Assessed by Tissue Dielectric Constant: Dependence on Nerve Territory and Posture
S. Carson¹ and HN Mayrovitz²
Colleges of Osteopathic Medicine¹ and Medical Sciences² Nova Southeastern University Davie Florida 33328

BACKGROUND and GOALS
Face skin properties vary among sites1-3 as do parameters such as skin blood flow (SBF) and transdermal water loss (TEWL). Check SBF is greater than forehead and check TEWL is less than forehead or chin. Since TEWL and SBF both affect local skin water (LSW) we reasoned that such regional differences may cause differences in facial LSW. Possible regional differences in LSW are consistent with the fact that skin territories of forehead, cheek and chin are innervated by different branches of the trigeminal nerve. Since these sensory nerves contain substance-P, the release of which can cause vascular permeability increased4,5, neural activity differences among regions might also lead to LSW differences. Thus one goal was to determine the extent of facial LSW variation among regions using skin tissue dielectric constant (TDC) measurements as an indicator of skin water contents6. Another physiological issue of interest was the effect of posture on LSW distribution. When a person is lying supine, gravitational forces act perpendicular to the plane of the lying surface, when sitting these forces act vertically downward causing force differentials among forehead, cheek and chin. We hypothesized such force differentials causes differences in facial area LSW. Thus our 2nd goal was to quantitatively characterize the effect of posture on the distribution of facial LSW among three differently innervated facial regions.

SUBJECTS
Thirty young adult males participated after signing a University Institutional Review Board approved informed consent. Age (mean ± SD) was 25.0 ± 2.5 years (range 21-31 years). Body mass index (BMI) for the group was 26.7±5.9 Kg/m² (range 17.1 – 35.8 Kg/m²). All were clean shaven.

METHODS

Comparison of Face TDC values with Forearm TDC values

Measurement Site

Forehead | Cheek | Chin | Forearm
---|---|---|---
Supine | 42.2 ± 2.7 | 38.8 ± 5.4 | 43.8 ± 4.2 | 32.8 ± 3.3
Sitting | 40.7 ± 2.3† | 37.2 ± 5.6† | 42.8 ± 4.2† | 31.2 ± 4.2†

Values are TDC mean ± SD. Left-right comparisons at each site indicate no significant difference in TDC values at corresponding sites in supine or sitting postures indicating facial symmetry. TDC values among sites (Forehead, Cheek and Chin) differ significantly (p<0.001) for both supine and sitting postures. For both postures chin values are less than either forehead or chin (p<0.001) and forehead values are less than chin (p<0.01). Changing from a supine to a sitting position is associated with a small reduction in TDC values at all sites (p<0.001).

DISCUSSION AND CONCLUSIONS

In addition to the face measurements, TDC reference measurements were made 10 min into lying and sitting on both volar forearms 8 cm distal to the antecubital crease.