

Skin Tissue Water Assessments in Different Races via Tissue Dielectric Constant Measurements
Sharien Amarnani¹ OMS-II, Eric Pitts¹ OMS-II, Louis Michaelos¹ OMS-II, Harvey Mayrovitz², PhD
, ¹College of Osteopathic Medicine, ²College of Medical Science, Physiology Department
Nova Southeastern University, Davie Florida 33328

Background: The Tissue Dielectric Constant (TDC) is directly related to the amount of free and bound water contained in the measuring volume. Thus, local skin tissue water indices can be determined by measuring TDC at any skin location. TDC values have been used as indices of tissue water magnitudes at several anatomical sites in healthy persons and changes associated with lymphedema and its treatment. Measurements in normal tissues have been used to establish a continuously developing reference data base from which judgments as to deviations from normality and effects of targeted therapies, including osteopathic lymphatic treatment modalities, might be judged. However, to date most TDC measurements have been made on Caucasians, none have been made on the clavicular chest region and possible effects of total body water (TBW) on TDC values is unknown.

Objectives: To measure chest, forearm and ankle skin TDC values and determine the relationship between TDC values and total body water in five different races; White, Black, Hispanic, Asian and Asian Indian. The goal is to evaluate at least 20 persons in each racial group.

Methods: TDC was measured in triplicate to depths of 1.5 and 5.0 mm bilaterally at the first intercostal space mid-clavicle (chest) and anterior forearm (arm) and to 1.5 mm at the medial malleolus (ankle). TBW was measured standing and supine with two different devices using bioimpedance measurements. To date, measurements have been done in a total of 42 subjects (23 male) divided as follows; White (16), Black(4), Hispanic(5), Asian(7) and Asian Indian(10).

Results: Composite TDC values (left and right sides) for chest, arm and ankle (n=84) were 36.0 ± 5.3 , 34.5 ± 3.1 and 28.2 ± 6.4 ($p < 0.001$) for 1.5mm effective depth measurements and for 5.0 mm depth at chest and arms were respectively 30.2 ± 4.7 vs. 30.0 ± 6.3 ($p = 0.751$). For all sites the 5.0 mm depth values were significantly less ($p < 0.001$) than corresponding 1.5 mm depth values. Standing and supine TBW% were $57.7 \pm 6.9\%$ vs. $56.3 \pm 5.79\%$. TBW% correlated best with the TDC values measured to an effective depth of 5.0mm on the arm ($r = 0.720$, $p < 0.001$). TDC values were similar on right and left sides at forearm and ankle with (right/left) ratios of 0.998 ± 0.054 and 1.028 ± 0.144 at 1.5 mm and 1.035 ± 0.087 at forearm at a 5.0 mm depth. Contrastingly, at a 5 mm depth, the right subclavicular area demonstrated a slightly, but significantly greater TDC value than on the left side (31.2 ± 4.8 vs. 29.2 ± 4.5 , $p < 0.001$) with a (right/left) ratio of 1.071 ± 0.099 .

Conclusions: The main focus of this presentation is on site and depth variations in TDC values and on characterizing possible TDC – TBW relationships. The data confirm that TDC values are less at greater depths at arm and chest and show TDC values to be least at the ankle. In addition, we demonstrate a significant positive correlation between arm TDC values and TBW% that has not previously been reported. These findings are useful additions to the evolving reference database to aid applications of TDC measurements in research and clinical practice including the possibility to monitor the progress and efficacy of OMT lymphatic treatments. The significant (right/left) subclavicular TDC differences herein reported may be due to different properties of the right lymphatic duct and the thoracic duct drainage territories.