

Age-Related Differences in Tissue Dielectric Constant Values of Female Forearm Skin Measured Noninvasively at 300 MHz

Harvey N. Mayrovitz, PhD, Professor of Physiology, College of Medical Sciences
Arash Zarrin, OMS-II, College of Osteopathic Medicine
Shalaka Akolkar, OMS-II, College of Osteopathic Medicine
Sunny Parekh, OMS-II, College of Osteopathic Medicine
Anita Singh, OMS-II, College of Osteopathic Medicine

Objective: To test the hypothesis that reported age-related shifts in skin water from less to more mobile states result in increased skin tissue dielectric constant (TDC) values with increasing age. Further, since skin-to-fat TDC values are used as a tool for edema and lymphedema assessment, a second aim was to establish reference values suitable for young and older women.

Background: TDC values depend strongly on water content and state and therefore changes in state likely effect the measured value of TDC. It has be stated that water state changes occur in aging but the effect of such changes on TDC values is undetermined.

Methods: TDC was measured bilaterally on volar forearm skin in young women (20-40 years) and older women that were at least 60 years of age. There were four different age groups studied having 50, 50, 100 and 50 subjects per age-group. These groups had TDC measurements to depths of 0.5, 1.5, 2.5 and 5.0 mm respectively.

Results: For each age-group TDC values decreased with increasing depth ($p < 0.001$). TDC values at 0.5 and 1.5 mm were greater for older women ($p < 0.001$). At 2.5 mm, there was no age-group difference ($p = 0.108$). At 5.0 mm the direction of the difference reversed with older TDC values less than the younger ($p < 0.001$).

Conclusions: Results are consistent with age-related shifts in water state from less-to-more mobile and explain depth-dependence differences between age-groups. Data also gives age-related TDC reference values for assessing local edematous or lymphedematous states.