

# Forearm Skin Tissue Dielectric Constant: Effect of Changes in Vascular Volume and Skin Blood Perfusion

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**Objective:** To determine vascular volume (VV) and skin blood perfusion (SBF) effects on skin tissue dielectric constants (TDC).

**Background:** Measuring TDC via the open-ended coaxial probe 300Mhz method is a useful non-invasive measure of local skin tissue water but VV and SBF effects on TDC is unknown. **Methods:** At a depth of 1.5mm TDC and SBF (laser-Doppler-Flowmetry) were measured on forearms of 20 subjects under two test conditions. Test 1 was done with the arm horizontal and then raised. Test 2 was done with the arm horizontal with and without a 50 mmHg cuff compression.

**Results:** For Test 1, horizontal TDC values of  $28.7 \pm 2.9$  decreased slightly but significantly on arm raising to  $27.8 \pm 2.5$ ,  $p < 0.01$ . For Test 2, TDC values of  $28.2 \pm 2.8$  increased slightly but significantly to  $29.2 \pm 3.1$ ,  $p < 0.01$  during upper arm compression. At the forearm site SBF significantly increased during Test 1 maneuver ( $+102.6 \pm 156\%$ ,  $p < 0.001$ ) and decreased during Test 2 maneuver ( $-39.5 \pm 13.1\%$ ,  $p < 0.001$ ).

**Conclusion:** Over the wide range of VV and SBF shifts used there was only a 3.0-3.5% change in TDC values. This suggests that for most clinical evaluation and tracking purposes the confounding effects of variations in SBF or volume are inconsequential. From the physiological perspective, the decrease in TDC with arm raising is consistent with a gravity-dependent drainage in vascular volume and the increase in TDC with application of cuff pressure is consistent with reduced drainage from vascular compression. The increase in forearm SBF agrees with previous work suggesting that venous emptying leads to arteriolar vasodilation.