Regional Differences in Human Skin Responses to Receptor Agonists: Implications for Differing Facial vs. Forearm Innervation

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There is not yet consensus on the precise differences between non-glabrous and facial skin characteristics. Our lab identified similar responses to local heat stress in forearm and facial skin, while others identified differing responses to autonomic stressors within facial regions. Anatomical differences, such as the thinner nature of facial skin and specifically its thinner stratum corneum, may also impact facial autonomic responses. Considering this layer is a protective barrier, facial skin may be more sensitive to perturbations like drug administration. While non-glabrous skin is innervated by spinal nerves, facial skin is innervated by cranial nerves. Because of these anatomical and physiological differences between non-glabrous and facial skin, it is possible that their differing neural and receptor characteristics impact a key autonomic end-organ response: cutaneous blood flow. In this pilot experiment, we investigated possible regional differences between the forehead and forearm in response to adrenergic and cholinergic agonists. We hypothesized that drugs targeting adrenergic (phenylephrine, clonidine, and isoproterenol) and cholinergic (acetylcholine) cutaneous receptors would elicit similar vasomotor effects in both locations. One female subject underwent forearm and forehead iontophoresis of each agonist using adaptations of published protocols, as well as a control protocol using deionized water (vehicle) alone. We recorded blood flow via laser-Doppler flowmetry (Moor Instruments) and beat-by-beat arterial blood pressure via finger photoplethysmography (ADInstruments). We calculated baseline cutaneous vascular conductance (CVC) and plateau 43°C CVC to determine the change in skin blood flow resulting from drug administration. Our results indicate that while phenylephrine administration caused vasodilation, opposing our hypothesis, administration of all other drugs caused responses in agreement with our expectations. Thus, these pilot data suggest that facial and non-glabrous skin may respond similarly to adrenergic or cholinergic agonists. These findings imply a potential use for topical dermatological drug treatments utilized on the trunk/extremities to benefit cutaneous facial diseases.