Cutaneous iontophoresis of adrenergic agonists can mimic *in vivo* neural effects on vasodilation

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Iontophoresis utilizes electrical current to non-invasively deliver agents through the skin. This pilot study sought to determine if iontophoresis could be paired with laser Doppler flowmetry (LDF) to administer adrenergic and cholinergic agonists and measure the subsequent changes in cutaneous blood flow. We hypothesized that iontophoresis administration would produce vascular tone changes consistent with those seen during other delivery methods. We iontophoresed phenylephrine, clonidine, isoproterenol, and acetylcholine to the forearm of one generally healthy 44-year-old female using existing or adapted protocols. We also created half-strength protocols with the goal of establishing dose-response relations. We quantified erythrocyte flux via LDF and beat-by-beat arterial blood pressure via finger photoplethysmography. After baseline, each drug was administered using its half and full-strength protocols, separated by a washout period. Finally, we stimulated maximal blood flow at each iontophoresis site via non-noxious local heating to 43°C. Cutaneous vascular conductance (CVC; laser Doppler flux/ mean arterial pressure) was calculated during baseline and following iontophoresis. We administered vehicle (deionized water) alone as a control, using the same protocols and analysis. The drug responses generally matched our predictions with the exception of phenylephrine, which caused vasodilation. Vehicle administration also caused vasodilation. Full-strength application generally led to a more pronounced change in CVC, suggesting that a dose-response relation might be established with additional data. Applications of certain agents led to a higher CVC than “maximal”, possibly raising the need to alter the method for establishing maximal cutaneous blood flow. Overall, our findings indicate that iontophoresis and LDF can be used to effectively administer adrenergic and cholinergic agonists to non-glabrous skin and affect vascular tone. This non-invasive technique could be used to investigate responses to these agents in those whose cutaneous neural receptor characteristics have been altered as a consequence of disease.