We present herein data showing for the first time to our knowledge that dry iontophoresis rapidly induces anhidrosis during current application in individuals with hyperhidrosis. This finding provides a novel experimental model for evaluating treatments of hyperhidrosis and determining their mechanism of action. Tap water iontophoresis, during which the patient’s hands are soaked in shallow pans of tap water, sometimes with drugs added (usually anticholinergic agents), has been in wide use for several decades, although little is known about its mechanism of action.1,2 While studying iontophoretic delivery of botulinum toxin to the palms of patients with hyperhidrosis, we noted that dry current alone induced relative palmar anhidrosis.3

Methods. To investigate the observed anhidrotic effect of dry iontophoresis, we recruited 6 patients (4 women and 2 men) with primary palmar hyperhidrosis and no clinically significant comorbid conditions or current medications. Ethical approval and written informed consent were obtained, and the study was conducted in accordance with the Declaration of Helsinki protocols.

The iontophoresis unit (Phoresor II; Iomed Inc, Salt Lake City, Utah) comprises a battery-operated base with twin lead cables attached to 2 conductive gel electrode pads, which were attached to the right and left upper limbs of subjects. We first assessed their baseline sweating by Minor starch-iodine test: iodine solution (2 g of iodine in 10 mL castor oil and ethanol to total 100 mL) applied to the palms followed by starch powder, which turned hyperhidrotic areas dark blue. Patients’ palms were digitally photographed 2 minutes after application of starch powder.4 Their hands were then washed and carefully dried to enable further assessment. All patients were also asked to self-rate their baseline sweating using a 100-point visual analog scale (VAS) (0, no sweating; 100, extreme sweating).

During the study treatment period, a 4-mA current was applied to the patients’ wrists via the conductive pads, and the Minor starch-iodine test was reapplied 1 minute after the start of current application. Two minutes later, the hands were photographed, with the current still switched on. The current was then switched off immediately, and the hands photographed again 2 minutes later. To quantify any change in sweating during current application, all patients were then asked to rate their level of sweating during the procedure on the 100-point VAS.

Results. Starch-iodine testing revealed a rapid and substantial reduction in sweating for the duration of the current application. It also showed that sweating returned rapidly to baseline within seconds to minutes after current cessation (Figure 1). Subjectively, the procedure led to a significant reduction in sweating during the time of current application, from a mean (SEM) VAS of 66.2 (6.9) before current application to 19.2 (6.2) during current application (P < .001 by t test) (Figure 2). This change corresponds to a mean (SEM) fold change of 0.31 (0.09) (P < .01 by t test).

Comment. The application of dry current provides a unique insight into sweating patterns during iontophoresis, and we document for the first time to our knowledge that sweating in primary palmar hyperhidrosis significantly diminishes during cutaneous current application and rapidly returns on removal of current. The electrochemical forces that drive sweat production and the
mechanism of iontophoresis are not understood. Our data support a rapid temporary interference with ion pumps and/or the innervation of eccrine sweat glands as at least partly explaining the mode of action of iontophoresis in hyperhidrosis.

Our results complement those of another study in which the repeated use of dry iontophoresis reduced sweating over time, although direct comparisons with tap-water iontophoresis are thus far lacking. These results imply that tap water, in traditional iontophoresis, may play no part other than acting as a conductor for current. This suggests that far less bulky iontophoresis machines requiring less space and resources could also be effective, although further studies are required to verify this proposition.

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