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Treatment of Excess Sweating of the Palms by Iontophoresis

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• **Eighteen subjects were treated for palmar hyperhidrosis by tap water iontophoresis. Only one hand was treated; the other served as a control. Fifteen of the 18 subjects became euhidrotic. Iontophoresis is a suitable alternative to long-term drug therapy and should be offered to patients for the control of palmar hyperhidrosis prior to surgical intervention.**

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Hyperhidrosis of the palms is a socially and occupationally distressing and sometimes disabling condition. The many attempts to treat hyperhidrosis with different methods, including such techniques as sympathectomy, emphasize the extent of interference with daily living that can result from this disease and the lengths to which patients will go

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to rid themselves of this distressing symptom. A simple, safe, and convenient method of treatment appears desirable. Of all the known remedies for palmar hyperhidrosis, iontophoresis is simple, safe, and effective.[1-6] The present controlled study clearly demonstrates the efficacy of tap water iontophoresis for the treatment of patients with hyperhidrosis.

PATIENTS AND METHODS

Eighteen patients, eight male and ten female, with significant palmar hyperhidrosis were recruited through an advertisement in a local newspaper. Significant hyperhidrosis was defined as excessive sweating of the palms resulting in a social or occupational handicap. Consent for participation in the study was obtained from the subjects after the nature of procedures had been fully explained and basic demographic data recorded.

The presence of hyperhidrosis was documented by applying 2% tincture of iodine to the skin of the palms and applying the hands to plain white paper' (Fig 1). This starch-iodine imprint served to qualitatively record the extent of the subjects' hyperhidrosis and in addition demonstrated that both hands were approximately equally affected. One hand was then randomly selected for treatment by tap water iontophoresis according to the method described by Levit.[6] The selected hand was immersed in a plastic tray of tap water with an electrode and exposed to 90 V and 12 to 20 mA of direct current for 20 minutes. A foot was placed in a second water-filled plastic tray with an electrode to complete the circuit. The second foot was not involved. At the end of ten minutes the polarity of the electrodes was reversed and the hand treated for the remaining ten minutes. This was done three times per week for three weeks using a galvanic generator (R. A. Fischer) to deliver the current. The hand that was not exposed to electric current was kept in a tray of tap water without an electrode during each treatment. Thus, each patient served as his or her own control.

The water and room temperatures were 20°C. Five days after the last treatment the degree of hyperhidrosis was recorded again with a starch-iodine imprint.

RESULTS

Seventeen of the subjects noted the onset of their hyperhidrosis in childhood or early adolescence. Five subjects gave a family history of the disorder. Their ages ranged from 20 to 46 years, with a mean of 29.5 years.

Fifteen of the 18 subjects experienced a marked reduction in sweating of the treated hand that was documented by starch-iodine imprint. Figure 2 is representative of the response observed. Indeed, their treated hands became euhidrotic. There was no change evident in the untreated hands. Two subjects did not improve subjectively or by starch-iodine imprint. One subject dropped out of the study because she feared that the transient erythema

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Fig 1.—Pretreatment starch-iodine imprint of palms.

Fig 2.—Five days posttreatment starch-iodine imprint. Note decreased sweating on nontreated (right) hand.

Treatment of Idiopathic Hyperhidrosis
Topical drugs
Antiperspirants, eg
20% aluminum chloride hexahydrate (Drysol)
2% to 5% tannic acid solution soaks
5% to 20% formaldehyde solution soaks
10% glutaraldehyde solution
Anticholinergics
Systemic drugs
Tranquilizers, eg, diazepam (Valium)
Anticholinergics, eg, methantheline bromide (Banthine), propanthelene bromide, methoscopolamine bromide (Pamine), glycopyrrolate (Robinul)
Surgical treatment
Excision of axillary sweat glands
Bilateral cervical sympathectomy
Electrotherapy
Percutaneous radiofrequency upper thoracic sympathectomy
Iontophoresis

involving her foot immediately following her treatments might lead to permanent discoloration of her skin.

Side effects were few. Open wounds on the treated hand were covered with petrolatum to avoid discomfort during treatment. All subjects were instructed in the use of the equipment since improper use can result in small shocks. Three patients experienced slight and transient vesiculation of the skin of their hand. Twelve subjects noticed redness of the skin along the water line for a number of hours after treatment. Two subjects complained of an intermittent tingling sensation in the treated hand and one stated that it sometimes lasted days. The discomfort was not sufficient to discourage either subject from subsequently selecting iontophoresis as a method to control their hyperhidrosis. None of the subjects experienced compensatory hyperhidrosis.

COMMENT

A large number of therapeutic options are available for the treatment of idiopathic hyperhidrosis (Table). The medical treatment of hyperhidrosis is usually ineffective in all but the mildest cases. Many topical agents have been used, including aluminum chloride, potassium permanganate, formaldehyde solution, glutaraldehyde, and various anticholinergic compounds.[8-11] Twenty percent aluminum chloride hexahydrate in absolute anhydrous ethyl alcohol (200 proof), available as a commercial prescription item (Drysol), is useful for some patients with axillary hyperhidrosis but is disappointing when used to treat the palms or soles. Furthermore, some of these agents are irritating, sensitizing, and may cause cosmetically offensive staining of the skin. Anticholinergic compounds have little effect when applied directly to the skin. When taken orally the dosages required to achieve a therapeutic effect are the same as those that cause side effects. The severity of these ocular and intestinal side effects limit their usefulness. A tranquilizer such as diazepam may be helpful for those patients who suffer hyperhidrosis during specific anxiety-producing situations.

Surgical intervention is frequently offered to the patient with severe hyperhidrosis.[12-14] The success rate of T2-3 sympathectomy is reported as 92% to 99%.[15-17] Among the complications of sympathectomy are compensatory hyperhidrosis (increased sweating in some other area of the body), 24% to 44%[15,18]; pneumothorax, 10% to 15%; permanent Horner's syndrome, 0.8% to 4%[15,18]; wound infection, 0.2% to 2%[15,17]; hemothorax, 0.2%[15]; intercostal neuralgia, 5%[15]; and empyema, 1.5%.[15] The efficacy of sympathectomy for palmar hyperhidrosis is not in doubt, but the problems that may occur as a result of this surgical intervention are significant.

The use of a radiofrequency technique for the destruction of sympathetic ganglia in the treatment of palmar hyperhidrosis appears beneficial and safe. More experience is necessary with this relatively new technique.[19,20]

By far the simplest and least expensive remedy for palmar hyperhidrosis is that of *iontophoresis*, which is defined as the introduction of an ionized substance through intact skin by the application of a direct current. In 1936, Ichihashi[21] used various solutions of atropine, histamine, and formaldehyde solution and by iontophoresis demonstrated that sweating of the palms could be reduced. His work went largely unnoticed until 1952 when Bouman and Grunewald Lentzer[1] published a report clearly demonstrating the efficacy of iontophoresis for the treatment of palmar and plantar hyperhidrosis in 113 patients. They demonstrated that the addition of an ionizable material to the water was not necessary to obtain a therapeutic effect. Simple tap water was sufficient. This study was also generally ignored until Levit,[5,6] in 1968 and 1980, published two reports exalting the efficacy and simplicity of tap water iontophoresis for the treatment of hyperhidrosis.

How does iontophoresis work? Why do the sweat glands seemingly shut down? Is the effect permanent? There are two currently accepted theories for the mechanism of action of iontophoresis on the human sweat gland. Both theories are related to observations made while studying experimentally induced miliaria rubra in areas other than the palms and soles. The first might be called the electrical gradient theory. Sulzberger and Herrmann[22] observed a reduction in the flow of sweat in volunteers who had miliaria induced by iontophoresis. They suggested that the normal movement of sweat along the sweat duct was the result of an electrical gradient. It was hypothesized that iontophoresis disturbed this gradient in such a way that sweat no longer flowed. If this is so, why do patients who have iontophoresis for hyperhidrosis of the palms and soles stop sweating for so many weeks? Could iontophoresis disturb the electroconductivity of the sweat duct for such a prolonged time?

The second theory might be called the "plug theory." Several authors[23-25] studying miliaria rubra induced by iontophoresis noted the formation of Schiff-positive, diastase-resistant material (plugs)

in the lumens of eccrine sweat glands. This, they stated, explained the development of the inflammatory lesions of miliaria rubra. Could plugs be responsible for the beneficial effects of iontophoresis of the palms and soles? In support of this second theory are two reports by Gordon and Maibach[26] and Grice et al[27] in which the effect of iontophoresis is reversed by cellophane tape-stripping of the skin overlying eccrine sweat glands that have been rendered euhidrotic by iontophoresis. Such stripping might remove a localized obstruction to the flow of sweat. That patients with palmar or plantar hyperhidrosis treated by iontophoresis do not develop miliaria and the information that Hill and others[28] have failed to demonstrate plugs or any other morphologic changes in the skin of successfully treated patients, however, speak against this theory. The mechanism of action of iontophoresis remains unexplained.

Limitations of this study were the small self-selected sample and the lack of quantification of results. The efficacy of iontophoresis in the treatment of 15 (83%) of 18 individuals with palmar hyperhidrosis was demonstrated. The research design eliminated heat and emotion as confounding factors. Water and room temperatures were maintained at 20°C. Emotional factors would be expected to affect both hands equally. All but three of the subjects in the study found iontophoresis dramatically effective for the control of their palmar hyperhidrosis and have commenced a maintenance program of treatments at one- to four-week intervals with their own iontophoretic devices. The approximate cost to the patient for the equipment necessary for home iontophoresis is $425. Although less expensive devices for iontophoresis are available (such as the Drionic unit), they have not yet been shown to be equal to the galvanic instrument used in this study. Iontophoresis is also effective in the treatment of plantar hyperhidrosis but disappointing when used to treat axillary hyperhidrosis.[1-6] The addition of pharmacologic agents to the water can enhance the efficacy of iontophoresis.[1,2,21] In those patients who fail to respond to simple tap water iontophoresis, such therapy may be of value.

In summary, this controlled study demonstrates that tap water iontophoresis suppresses palmar hyperhidrosis. With instruction, tap water iontophoresis is safe for unsupervised treatment of hyperhidrosis. Iontophoresis is a simple, economic, and effective therapy that should be offered to patients with palmar hyperhidrosis prior to surgical intervention.

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