Treatment of palmar hyperhidrosis using tap water iontophoresis: local experience

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To evaluate the efficacy and safety of tap water iontophoresis in the treatment of severe idiopathic palmar hyperhidrosis, nine Chinese patients with severe palmar hyperhidrosis that had failed to respond to topical aluminium chloride were given 6 weeks' treatment with tap water iontophoresis at the Social Hygiene Service, Department of Health, Hong Kong. The reduction in sweat output was assessed objectively and subjectively. The mean objective reduction in sweat output was 49%, 51%, 26%, and 22% at week 3, 6, 10, and 12, respectively, since the start of treatment with tap water iontophoresis. The mean subjective improvements were 43%, 59%, 30%, and 12% at week 3, 6, 10, and 12, respectively. The side effects reported were all mild and transient. We conclude that tap water iontophoresis is a safe and useful treatment modality for palmar hyperhidrosis.

HKMJ 1999;5:191-4

Key words: Hand; Hyperhidrosis/therapy; Iontophoresis/methods; Sweat/secretion

Introduction

Sweat glands on the palms and soles are activated predominantly by emotional stimuli, whereas sweat glands elsewhere are activated by a rise in the ambient temperature. Sato et al[1] have speculated that the hypothalamic sweat centre that controls sweating in the palms and soles is distinct from the rest of the hypothalamic sweat centres. Palmar hyperhidrosis is a common condition that is frequently exacerbated by emotion and anxiety. Severe palmar hyperhidrosis can be a very distressing condition and have a negative impact on life, both physically and psychologically. The conventional treatment is topical aluminium chloride solution; however, it is not always effective. An alternative is the use of anticholinergic drugs, which may produce some clinical improvement; however, side effects such as drowsiness and blurred vision are inevitable. And cervical sympathectomy is an invasive procedure that causes morbidity and may cause compensatory hyperhidrosis.

Iontophoresis is the use of an electromotive force to enhance percutaneous absorption of a drug or chemical. In 1948, in a study designed to experimentally induce sweat retention and miliaria, Shelley et al[2] succeeded to induce anhidrosis in 35 subjects following the application of a direct current by using tap water and a specially constructed iontophoretic unit. Tap water iontophoresis (TWI) is now a recognised treatment modality for palmar and/or plantar hyperhidrosis, and a direct current between 0.5 and 20 mA is commonly used.[3] However, local experience of TWI to treat palmar and plantar hyperhidrosis is limited. This study aimed to evaluate the efficacy and safety of TWI in the treatment of severe idiopathic palmar hyperhidrosis.

Methods

Inclusion criteria

Patients who presented to the Social Hygiene Service, Department of Health, Hong Kong from July 1996 to June 1997 with severe palmar hyperhidrosis, to the extent that their palms were wet during most of the day, were given 6 weeks of TWI treatment. Only cooperative patients who would be able to make a subjective assessment of the sweat output and who were aged 12 to 50 years were included. A voluntary consent form was signed after the procedure and

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possible side effects had been explained. All patients had been given topical aluminium chloride solution once every night for at least 4 weeks prior to the study but had had a poor response. A 'washout' period of at least 4 weeks was allowed before starting TWI.

Exclusion criteria

Patients with medical conditions that were associated with hyperhidrosis were excluded. These conditions included hyperthyroidism, diabetes mellitus, parkinsonism, phaeochromocytoma, spinal cord injury, brain damage, congestive heart failure, anxiety, dumping syndrome, alcoholism, and menopause. Any treatment with a drug that would affect sweating (eg thyroxine, anxiolytics, topical aluminium chloride, or topical potassium permanganate) was stopped for at least 4 weeks preceding the study. Patients with cardiac conditions such as arrhythmia or ischaemic heart disease; low exercise tolerance; or low respiratory reserve were excluded. Patients who had a local wound, severe eczema, or severe fungal infection of the palms were also excluded to minimise the risk of local burn.

Treatment procedure

Tap water iontophoresis was performed at the Physiotherapy Department at the Tuen Mun Hospital. An electric stimulator using an alternating current (Dynatron 438; Enraf, Delft, Holland) was used to produce a pulsed direct current. During treatment, both hands in the pronated position were immersed in tap water; the palms were placed flat and in contact with a felt pad that was connected to the anode. The cathode was placed on the elbows. A pulsed direct current of a 900-ms pulse width and a 100-ms rest period was used to minimise the risk of burn. The current intensity was adjusted according to the degree of tingling sensation in the palms to suit each patient's maximum tolerance level. Treatment was administered for 20 minutes per session, with three sessions a week, for 6 weeks.

Assessment

Clinical assessment consisted of the objective and subjective assessment of treatment efficacy and the recording of adverse effects and tolerability. Assessments were made pretreatment (week 0), at weeks 3 and 6 of treatment, and after 4 weeks (week 10) and 6 weeks (week 12) of stopping the TWI treatment. Any improvement of hyperhidrosis was also made subjectively by the patient every week after the commencement of treatment.

Measurement of sweat reduction

The efficacy of TWI was assessed objectively by measuring the reduction in sweat output. The clinical improvement was classified as a mild (0%-24%), moderate (25%-49%), or significant (50%-100%) reduction in sweat output. Patients were asked to exercise and then to sit in an air-conditioned room whose ambient temperature was 15 to 20°C and humidity was 70% to 85%. Palms were dried by wiping with tissue once and their sweat output was measured by recording the mass gained by a standard diaper of approximately 30 g that was placed in contact with the palms for 10 minutes. The percentage sweat reduction after TWI was calculated as follows:

$$\frac{\text{(Pre-TWI sweat output} - \text{sweat output after TWI)}}{\text{Pre-TWI sweat output}} \times 100$$

Sweat reduction was also subjectively recorded by patients using a visual analogue scale of 0 to 100 at the end of each week of treatment.

Adverse effects and tolerability of tap water iontophoresis

Any adverse effects attributed to the TWI treatment were recorded during the study. The tolerability of TWI was rated in five grades—namely, excellent, very good, good, fair, and unsatisfactory.

Table 1. Clinical data and objective response to tap water iontophoresis

Patient No.	Sex/age (years)	Sweat output reduction (%) Week 3	Week 6	Week 10	Week 12	Maximum current (mA)	Side effects	Tolerance
1	M/26	90	90	89	36	12.0	None	Excellent
2	F/47	15	58	5	2	14.0	None	Very good
3	F/28	54	65	23	0	12.0	Mild erythema Small vesicles	Good
4	M/36	66	68	Defaulted	Defaulted	22.0	Small vesicles	Fair
5	F/38	77	82	45	0	9.0	Small vesicles	Excellent
6	M/42	63	40	29	30	7.6	Small vesicles	Very good
7	M/22	9	0	0	72	6.6	None	Excellent
8	F/19	2	0	9	0	7.0	Small vesicles	Very good
9	M/16	65	60	12	38	9.0	None	Good
Mean		49	51	26	22			

Results

Nine Chinese patients were studied during the 12-month period; there were five men and four women. Their mean age was 30.4 years (range, 16.0-47.0 years). The mean maximum current used was 11.0 mA (range, 6.6-22.0 mA).

The demographic data and objective data regarding sweat reduction are shown in Table 1. The mean objective improvement as assessed by the sweat output method was 49%, 51%, 26%, and 22% at week 3, 6, 10 and 12, respectively. The numbers of patients attaining mild, moderate, and significant clinical improvement are shown in Figure 1. By the end of week 3, three (33.3%) patients showed mild improvement and six (66.7%) of the nine patients had already attained significant improvement. At the end of week 6, one patient showed moderate improvement and six patients were able to maintain a significant improvement. One patient (patient 4) defaulted follow-up after the completion of TWI. At week 10, one patient (patient 1) maintained a significant improvement, but a relapse of hyperhidrosis occurred in the other patients.

The percentage of improvement for each patient as assessed by using the visual analogue scale is shown in Table 2. The mean subjective improvement at week 3, 6, 10, and 12 was 43%, 59%, 30%, and 12%, respectively. The results from the subjective assessment of efficacy are shown in Figure 2. At week 3, four (44.4%) patients reported significant improvement while at week 6, seven (77.8%) patients reported significant improvement. At week 10, three (37.5%) of eight patients who attended follow-up maintained a significant improvement. In general, results from the objective and subjective methods of assessment corresponded well. Discrepancies of results in some patients may be related to the difference between the objective and subjective methods of assessment. In addition, many factors affect sweat output, such as ambient temperature, humidity, and psychological factors.

Table 2. Subjective response to tap water iontophoresis, as measured by using the visual analogue scale

Patient No.	Subjective improvement (%) Week 3	Week 6	Week 10	Week 12
1	80	70	70	10
2	50	50	50	50
3	25	50	0	0
4	85	85	Defaulted	Defaulted
5	30	100	50	0
6	50	80	30	0
7	20	50	20	0
8	35	30	0	40
9	10	15	20	0
Mean	43	59	30	12

Adverse reactions were transient and mild, and a tingling sensation occurred in all patients. One patient had erythema and in five, small vesicles developed, which subsequently subsided spontaneously. No patient experienced burn or electric shock. The TWI treatment was well tolerated by all patients and tolerance was reported to be excellent by three patients, very good by three, good by two, and fair by one patient.

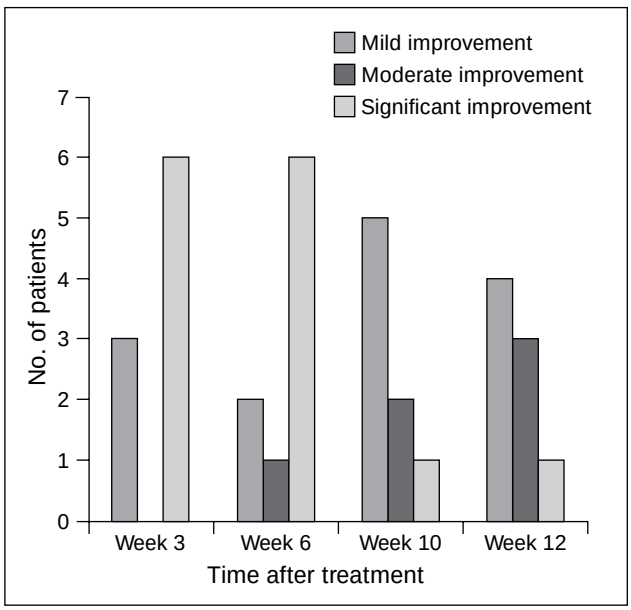

Fig 1. Objective response to tap water iontophoresis, as measured by using the sweat output method

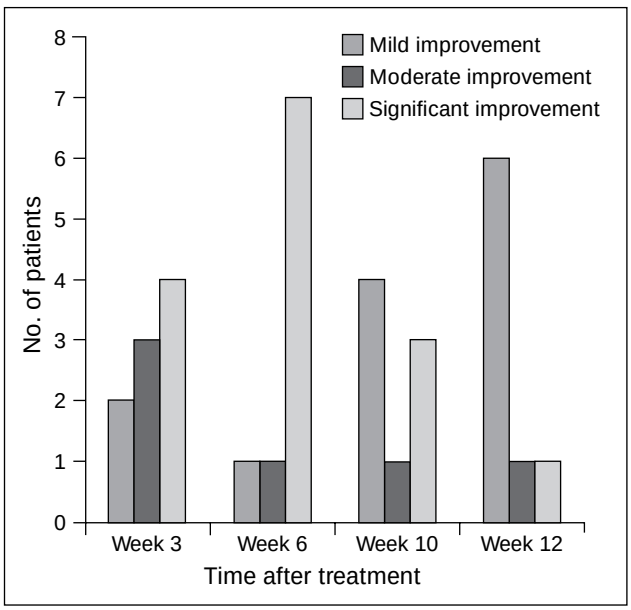

Fig 2. Subjective response to tap water iontophoresis, as measured by using the visual analogue scale

Discussion

Bouman et al[4] were the first group to apply iontophoresis to treat hyperhidrosis and they achieved improvement in 90% of 113 patients in one hand following the application of a direct current while the other hand served as a control. A similar efficacy was demonstrated in subsequent studies.[5-7] The mechanism of action of TWI is unknown but the induction of hyperkeratinisation and the subsequent obstruction of the eccrine sweat duct unit has been proposed.[2] Templeton et al[8] have suggested that anhidrosis due to iontophoresis results from ductal blockage without damage to the sweat glands.[8] Holzle and Ruzicka[9] have suggested that iontophoresis works by blocking neuroglandular transmission or inhibiting the secretory mechanism at the cellular level. However, none of these suggestions have been proven by histopathological study of biopsy specimens.[10]

Tap water is used in iontophoresis because it is convenient and easily available. Iontophoresis using normal saline solution is not as effective as that using tap water.[11] Using anticholinergic agents, however, has been shown to be more effective than tap water,[12] but also results in systemic side effects. An electric current in an aqueous solution is carried by charged ions; thus, it is unclear as to why plain water is more effective than saline and how anhidrotic effects of TWI arise.[11]

As shown in our study, a response to TWI was observed at week 3 and two thirds of the patients achieved a good response after 6 weeks' treatment, although the therapeutic efficacy gradually reached a plateau. As hyperhidrosis is a chronic problem, maintenance therapy should be given after an initial improvement has been attained. The simplicity of the treatment procedure, a high degree of safety, and the recent availability of portable iontophoretic units has made home therapy possible. The high efficacy of a unit for home therapy has been well documented by Akins et al[13]—80% of the hand sites, 33% of the sole sites, and 37.5% of the axilla sites showed at least 50% improvement within 14 days' treatment. In addition to treating hyperhidrosis of the palms, soles, and axillae, TWI may help diseases that are made worse by hyperhidrosis such as dyshidrosis, contact dermatitis, tinea pedis, tinea manuum, and plantar warts. Thus, TWI has a wide range of uses in dermatological practice. From this study, we conclude that TWI is a safe and alternative treatment modality for patients with palmar hyperhidrosis who are intolerant to and/or do not show a satisfactory response to topical antiperspirants.

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