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Case Study

Comparison of Tap Water and Normal Saline Iontophoresis in Idiopathic Hyperhidrosis: A Case Report

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Abstract. [Purpose] The purpose of this study was to evaluate the efficacy of tap water (drinking water) and normal saline (sodium chloride solution 0.9%) iontophoresis treatment for a patient with idiopathic hyperhidrosis [Subjects and Methods] In this study, tap water and normal saline iontophoresis were used to treat a 21 year-old female who was suffering from severe palmoplantar idiopathic hyperhidrosis. Post-iontophoresis sweat intensity of 8 treatment sessions were averaged and then normalized relative to the corresponding mean value which was obtained before iontophoresis treatment. [Results] The subject showed 24.72% and 42.01% decreases in sweat intensity following tap water and normal saline iontophoresis, respectively. [Conclusion] Tap water and normal saline iontophoresis are effective in the treatment of idiopathic hyperhidrosis. However, normal saline iontophoresis is 1.7 times more effective than tapwater iontophoresis at obstructing secretion.
Key words: Hyperhidrosis, Iontophoresis, Saline solution

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INTRODUCTION

Idiopathic (primary) hyperhidrosis is defined as excessive sweating with no clear cause. Excessive palmoplantar, axillae, facial, or cervical region sweating in idiopathic hyperhidrosis usually occurs bilaterally and causes social, psychological, emotional, and professional difficulties for the afflicted. The incidence of idiopathic hyperhidrosis is reported to be between 0.6 to 2.8% in both genders[1–3)]. Idiopathic hyperhidrosis may begin in childhood and continues for the rest of the subject's life. It does not occur during sleep, for it is normally stimulated by emotion and stress which are controlled by the cortex[4, 5)].

A variety of treatments have been proposed to control or decrease the sweating of idiopathic hyperhidrosis. Systemic anticholinergic drugs are somewhat effective at controlling the secretion, but long term usage of the drugs and adverse side effects make them unsafe and ineffective. Injection of botulinum toxin A (Botox) is painful and requires regular injection with the use of anesthetic. As well as having some side effects, it is an expensive treatment too[4, 6, 7)]. If patients fail to respond to drug and injection therapies, surgical treatment including sympathectomy may be considered for idiopathic hyperhidrosis of the palms. However, some considerable post-surgical dysfunction usually limits the practice of sympathectomy for idiopathic hyperhidrosis of the soles[2, 3)].

Iontophoresis was first established in 1952. It is an electrical treatment that includes local absorption of a drug or chemical, in the forms of ions, on the skin. It is used in local anesthesia, antibacterial modality, neurogenic pain relief, edema, chronic ulcer repair, skin fungal infection, and hyperhidrosis. It has been proved to be a safe, effective, and inexpensive treatment. If it is applied appropriately, it normally does not have any adverse side effects[6, 8–10)]. Iontophoresis of tap water (drinking water) and normal saline (sodium chloride solution 0.9%) in idiophatic hyperhidrosis are relatively common treatments[11)]. However, there is controversy in the literature about the use of tap water as an agent, as tap water differs with area depending on its ions and compositions. We were not aware of any local use of tap water iontophoresis in the treatment of idiopathic hyperhidrosis. Therefore, the purpose of this study was to evaluate the efficacy of our local tap water in conjunction with iontophoresis in the treatment of idiopathic hyperhidrosis in comparison with normal saline (as a standard liquid) iontophoresis.

SUBJECTS AND METHODS

We present the case of a 21 year-old female who voluntarily participated in this study. She was first informed of the purpose and the study protocol. Her written, informed

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consent was then obtained, and the protocol was approved by the Tabriz University of Medical Sciences Ethics Committee. Her condition was diagnosed to be idiopathic hyperhidrosis, following the definition of Hornbeerger et al. for idiopathic hyperhidrosis[4]: visible and excessive sweating for a minimum 6 months duration and at least two of the following features: 1) bilateral and relatively symmetric sweating, with similar sweat measurements indicating that the severity of hyperhidrosis in both hands is similar, 2) disruption of daily physical activities, 3) having at least one sweating period in a week, 4) occurrence of sweating below the age of 25, 5) having a family history of sweating, and 6) having no sweating during sleep. Our patient had almost all of the above mentioned features with the sweating first occurring at 8 years old, and no history of medical, social, or psychological conditions that were possibly associated with hyperhidrosis. She had received no treatment for at least one year before the study. According to the Hyperhidrosis Disease Severity Scale (HDSS)[12], the sweating of the palms was severe and greater than that of the soles; so we treated the palms of the patient in this study.

Tap water and normal saline iontophoresis were performed at the physiotherapy clinic of the Faculty of Rehabilitation. After a brief explanation, the patient was asked to wash her palms and dry them by wiping with a tissue. The sweat measurement was performed using the pad glove method described by Kalkan et al[13]. Briefly, a pair of cotton gloves and a pair of surgical gloves were weighed on an electronic scale with 0.0001 g sensitivity. Our patient was then asked to wear the cotton gloves and then the surgical gloves on top of them on both hands. She sat on a comfortable chair for 10 min. while rubbing her hands together, followed by careful removal and immediate re-weighing of the gloves. The difference in the weight of the gloves before and after the 10 min of wearing the gloves was determined as the intensity of sweat in each treatment session and calculated as g/h. The subject was then asked to place her right palm in 400 mL tap water within a fiberglass tub with the dimensions of 15 × 24 cm. Similarly, the left palm was placed in normal saline. The right and left palms were in contact with rubber pads (4.5 × 3.5 cm) that were connected to the negative and positive electrodes, respectively. The electrodes were then connected to a Power Stim. 733A, direct current (DC) stimulator, which kept the voltage constant, and DC pulses were delivered with increasing intensity (up to 20 mA) until the tolerance limit was reached. The DC stimulator was used for the conventional iontophoresis treatment as DC causes fewer adverse reactions (such as pain, skin burning, itching, and irritation) than alternating current (AC). Additionally, using DC with careful selection of treatment factors such as treatment time period and intensity of DC decreases the possibility of adverse reactions. The tap water and normal saline iontophoresis were administered for 30 min in each session, with 8 applications on days 1, 2, 4, 7, 11, 16, 21, and 28 of the study[13].

At the end of each session, the patient was asked to wash her hands and dry them by wiping with a tissue. In order to determine the intensity of sweat following iontophoresis application, the pad glove method, described above, was performed again at the end of each session.

Subjectively, the patient was asked to report the intensity of sweat using the dermatology life quality index (DLQI) questionnaire[14], which has a maximum possible score of 30 (the worst possible outcome), at the end of each week of the study. She was also asked to report any sweat intensity change on the soles.

Room temperature and humidity were kept constant during the treatment sessions. The patient was also asked not to use any medication during the study.

In order to determine the effectiveness of the iontophoresis application, the post-iontophoresis sweat intensities of 8 treatment sessions were averaged and normalized relative to the corresponding mean value obtained before iontophoresis.

Table 1. Sweat decrease (%) following tap water and normal saline iontophoresis in the 8 treatment sessions (1–8)

	Sweat decrease (%)	
Treatment session	Tap water iontophoresis	Normal saline iontophoresis
1	38	64
2	43	59
3	70	73
4	38	48
5	80	84
6	31	45
7	11	53
8	29	44

Sweat decrease (%) was calculated as follows: (Pre tap water iontophoresis sweat intensity − post tap water sweat intensity)/(pre tap water sweat intensity) × 100%

RESULTS

We observed 24.72% and 42.01% decreases in the sweat intensity of the patient over the 8 treatment sessions with tap water and normal saline iontophoresis, respectively. The percentages decrease in sweat after iontophoresis treatment in each session are shown in Table 1. The patient answered the DLQI questionnaire during the first session, and at 2 and 4 weeks after the start of treatment; the scores were 14, 9, and 7, respectively. She also reported a 20% decrease in sweat on the soles at 4 weeks after the start of the iontophoresis treatment.

DISCUSSION

Tap water and normal saline iontophoresis are said to be the effective, safe, and inexpensive treatments for idiopathic hyperhidrosis with minimal adverse side effects. Similar to some findings, we showed the efficacy of our local tap water[2, 4, 15, 16] and normal saline[11] in iontophoresis treatment for idiopathic hyperhidrosis. However, in contrast to some findings[11], the efficacy of normal saline iontophoresis was

greater (70% more efficient) than that of tap water iontophoresis. Although some mechanisms have been proposed to explain the improvement in hyperhidrosis after iontophoresis[17, 18], the exact mechanism behind this improvement is not known. For instance, pore obstruction of sweat ducts secondary to hyperkeratinization, impairment of the electrochemical gradient of sweat, and biofeedback mechanism may be involved in hyperhidrosis following iontophoresis using tap water or normal saline. Subjectively decreased sweat on the soles of our case may be associated with a biofeedback mechanism which needs further investigation.

As shown in Table 1, we observed decreases in sweat after every treatment session, with averages of 25% and 42% for tap water and normal saline iontophoresis, respectively. This indicates that iontophoresis is an effective treatment with an immediate result, possibly due to mechanical or electrochemical occlusion of sweat ducts which lasts for at least four weeks. The residual effect of iontophoresis on sweat decrease is controversial in the literature[19]. It may be associated with the type of currents (DC or AC), intensity or duration of the treatment, electrode placement, or local tap water which differs with area. Further investigation is needed to explain the mechanism of iontophoresis in hyperhidrosis and its residual effects. Support for our finding about the effectiveness of iontophoresis was provided by the DLQI questionnaire scores. In our study, the DLQI questionnaire scores progressively decreased after 2 and 4 weeks of treatment, and the decrease may have been associated with an improved quality of life.

In our area, the tap water is said to be hard which may have adversely affected the efficacy of the treatment compared with normal saline. In most research, hydrolysis of ions OH^- and H^+ is reported to be associated with the degree of efficacy[19]. It seems that hard water might have different ions and compositions which might adversely affect the degree of efficacy. However, normal saline is considered a standard liquid with almost similar efficacy in the literature. Equipment settings and methodology might have affected the efficacy of iontophoresis with normal saline, as reported in the literature[11]. In summary, we report successful tap water and normal saline iontophoresis treatment for idiopathic hyperhidrosis. However, normal saline iontophoresis was 1.7 times more effective than tap water iontophoresis at obstructing secretion.

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