

Aluminum Chloride Hexohydrate Versus Tap Water Iontophoresis with Direct Current on Palmer Hyperhidrosis

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ABSTRACT

*The purpose of the current study was to investigate the effect of Aluminum chloride hexohydrate versus tap water iontophoresis with direct current on palmer hyperhidrosis. Subjects, thirty subjects were included in this study (20 males and 10 females). They had idiopathic palmer hyperhidrosis. Their ages ranged from 25 to 35 years old.. The subjects wear divided randomly into two equal groups of equal number. The first group (15 patients) received 6 weeks of treatment with Aluminum chloride hexahydrate according to the criteria used in topical therapy. The second group (15 patients) treated with tap water iontophoresis with direct current for 6 weeks. **Assessment** of sweat out put was measured by recording the mass difference in the standard diaper (20 gm) through a sensitive mass scale. And a percentage of sweat change was calculated before starting the study and after 6 weeks of treatment in both groups. The hyperhidrosis severity was determined before starting and at the end of the study using Hyperhidrosis Disease Severity Scale (HDSS). **Procedures:** Patients of the first group applied the aluminum chloride to dry skin nightly for one month and day off for 2 weeks. In second group the hands were immersed in a container tap water. The palms were placed in contact with a felt pad that was connected to the anode of electric stimulation with direct current the cathode was placed over the elbows. The direct current intensity was applied according to the subjective sensation of patients on the palms (Tingling sensation). The treatment was performed 30 minutes per session, three times per week for 6 weeks. **The results** of this study showed a significant reduction in sweat production in 2nd group (66.8 %) than that resulted in 1st group (28.53%) and significant improvement of HDSS in 2nd group. It was concluded that tap water iontophoresis using direct current is more effective as a treatment for palmer hyperhidrosis as compared to the topical application of Aluminum chloride hexohydrate.*

Key words: Palmer Hyperhidrosis, Aluminum chloride, Iontophoresis, Direct current.

INTRODUCTION

Sweating is a physiological response to body overheating. It is controlled by the heat regulatory center in the hypothalamus. As the temperature of the environment rises, the body is cooled by vasodilatation of the cutaneous blood vessels and the production of sweat. The sweat then evaporates from the surface of the skin and cools the body¹.

Hyperhidrosis is a condition characterized by excessive sweating beyond the physiological need. Almost 3% of the general population, experience hyperhidrosis. It can be generalized involving the entire body or focal hyperhidrosis which is idiopathic, occurring in otherwise healthy people. It affects one or more body areas, most often the palms, armpits, soles or face. Focal hyperhidrosis affects both men and women equally, and its

prevalence was found to be the highest among people aged 25–64 years¹.

Palmoplantar hyperhidrosis is a common condition in which the eccrine glands of the palms and soles secrete inappropriately large quantities of sweat. The condition may become socially and professionally debilitating².

People with palmer hyperhidrosis may be embarrassed to hold hands or to shake hands because of having excessively wet palms, they may have difficulty holding onto objects or tools or using computer keyboards, or typewriters. Papers they handle may become wet, and metal objects that they use repeatedly may become rusty. They may find it difficult to play a musical instrument or perform a job requiring the wearing of gloves. Patients may have a predisposition to bacterial and fungal infections. They may develop psychiatric problems³.

Numerous medical, surgical and physical therapy treatment options are now available. The treatment options include topical and systemic medications, iontophoresis, injections of botulinum toxin, and sympathectomy⁴.

It was suggested that most effective topical treatment for palmoplantar hyperhidrosis is 20 percent aluminum chloride hexahydrate in absolute anhydrous ethyl alcohol. Aluminum chloride is thought to obstruct sweat pores and induce atrophy of secretory cells within the sweat glands. Less satisfactory results have been achieved with other topical agents, including boric acid, anticholinergic drugs, resorcinol, tannic acid, potassium permanganate, formaldehyde, methenamine, and glutaraldehyde. The only contraindication to this treatment is documented hypersensitivity⁴.

Tap water iontophoresis is considered by many dermatologists to be an effective treatment for hyperhidrosis of the palms and

soles, the mechanism of action of tap water iontophoresis in reducing sweat output, is currently not understood⁵.

On the other hand it was reported that tap water iontophoresis with continuous direct current represents the therapy of choice in palmoplantar hyperhidrosis⁶.

It was observed from the previous literatures, a lack of documented data on the therapeutic effect of tap water iontophoresis using direct current as a physical therapy modality on Palmer hyperhidrosis as compared to the effect of Aluminum chloride hexohydrate.

Furthermore the current study is an attempt to introduce a plan of physical therapy for palmer hyperhidrosis. The results of this study might help physician, physical therapist to apply ideal treatment for these patients.

Therefore the aim of current study was to investigate the effect of Aluminum chloride hexohydrate versus tap water iontophoresis with direct current on Palmer hyperhidrosis.

SUBJECTS, MATERIALS AND METHODS

Thirty subjects were included in current study (20 males and 10 females). They had palmer hyperhidrosis. Their ages ranged from 25 to 35 years old. The study were conducted in faculty of physical therapy Cairo university. The study included idiopathic hyperhidrosis only, while patients with medical conditions that were associated with hyperhidrosis were excluded. On the other hand any treatment with a drug that would affect sweating was stopped at least 4 weeks before the beginning of the study. Also the study excluded patients with cardiac condition, those who had local wound, diabetic patients, loss of sensation or recently shaven skin. The design of the study was pre- test, post-test design. The subjects

wear divided randomly and equally into two groups:

Group 1: Fifteen patients (9 males and 6 females). This group received 6 weeks of treatment with Aluminum chloride hexahydrate according to the criteria used in topical therapy.

Group 2: Fifteen patients (12 males and 3 females). This group treated with tap water iontophoresis with direct current for 6 weeks.

I. Equipments

(A) Evaluative equipment

A standard diaper of approximately 20 g was used. This diaper was placed in contact with the palms for 15 minutes. The sweat output was measured by recording the difference in mass through a sensitive mass scale, percentage of sweat reduction was calculated.

(B) Hyperhidrosis Disease Severity Scale (HDSS)

A subjective scale was used in current study to determine the severity of disease. It is composed of four-point scale to detect severity of Palmer hyperhidrosis⁷ as shown in table (1).

Table (1): Hyperhidrosis Disease Severity Scale (HDSS)⁸

My sweating is never noticeable and never interferes with my daily activities.	Score 1
My sweating is tolerable but sometimes interferes with my daily activities.	Score 2
My sweating is barely tolerable and frequently interferes with my daily activities.	Score 3
My sweating is intolerable and always interferes with my daily activities.	Score 4

Therapeutic Equipment

Direct current generator (Phyaction 780, Uniphy BV, Netherland) was used to produce tap water iontophoresis.

Procedure

Evaluative procedure: It was performed before the study and after 6 weeks of treatment and included.

(A) Percentage of sweat output difference⁶

Percentage of sweat output difference was calculated as follows

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

Each subject was instructed to perform mild exercise (running for 5 minutes on electric treadmill 5km/H) and then to sit in an air-conditioned room whose ambient temperature was 15 to 20°C and humidity was 70% to 85%. Each subject was instructed to

dry by his palm wiping with tissue. Each subject was asked to put his palms on a standard diaper of approximately 20 g on his front table for 15 minutes. Then using a sensitive mass scale the percentage of changes was calculated according to the previous equation. The procedure was performed pre-treatment after 6 weeks of treatment in both groups.

(B) Hyperhidrosis Disease Severity Scale (HDSS)

The hyperhidrosis severity was determined before the beginning of the study and once again at the end of the study.

(B)Therapeutic procedure

1- Topical Treatment

Patients was applied the aluminum chloride to dry skin nightly for one month and day off for 2 weeks. In the morning patient

were instructed to wash external aluminum chloride. For obtaining satisfactory results the solution must be applied for 6-8 hours on dry skin if the area was moist, hydrochloric acid may be formed, resulting in severe irritation. The solution must be applied before go to bed as the activity of the eccrine sweat glands decrease during sleep at night⁴.

2- Iontophoresis

This procedure was performed at the out clinic of faculty of physical therapy, Cairo University. Each patient was instructed to sit in front of a box filled with tap water. Both forearms were positioned in pronation, while the hands were immersed in tap water. The palms were placed in contact with a felt pad that was connected to the anode with direct current (Phyaction 780, Uniphy BV, Netherlands). The cathode was placed over the elbows. The direct current which used at 20 mA, the intensity was applied according to the subjective sensation of patients on the palms (tingling sensation). Patients were instructed not to try to remove their hands. The treatment was performed 30 minutes per session, three times per week for 6 weeks. After session each patient was instructed to dry his palms and stay for 10 minutes rest before leaving.

(C) Data analysis

The mean, standard deviation, maximum, minimum values, and the percentage of sweat production were calculated for all patients.

* The comparison between two groups was performed by using student t- test to identify differences between results collected in the two groups (concerning sweat production).

* Non-parametric analysis for HDSS was performed.

* The data analysis and the level of significance was set at 0.05 level.

RESULTS

In this study the effect of tap water iontophoresis on Palmer hyperhidrosis was compared to that of aluminum chloride hexohydrate.

As shown in table (1) and figure (1) the mean values of the mass of sweat production in group one was 13.8 ± 2.27 gm while it was 13.06 ± 1.9 gm in group two reflecting a non significant difference ($P < 0.05$) in sweat production mass between both groups.

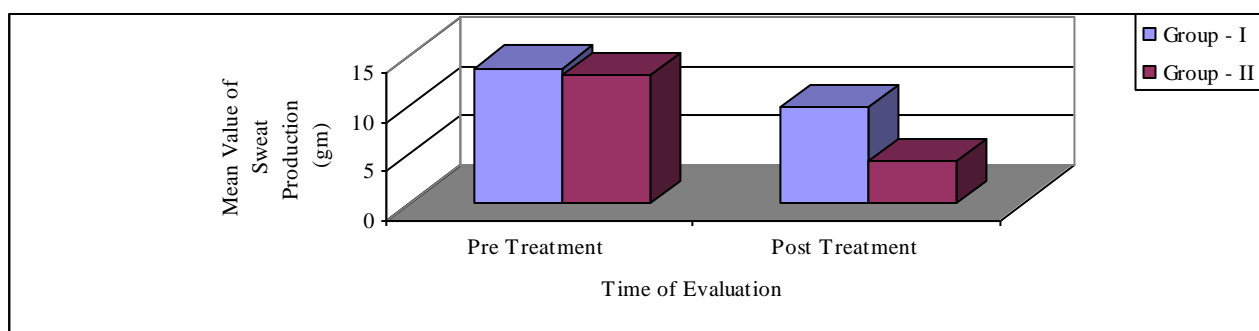
On the other hand at the end of the study the mean values was 9.86 ± 2.4 gm for group one with a mean percentage of reduction in sweat production 28.53 ± 10.87 %, while it was 4.4 ± 1.59 gm in group two with a mean percentage of reduction in sweat production 66.8 ± 9.77 % as shown in table (2) and figure (2), reflecting a significant ($P < 0.05$) reduction in sweat production in group two than that observed in group one.

Concerning the results of Hyperhidroses Disease Severity Scale (HDSS) as shown in table (3) and figure (3) at the start of the study there was no significant difference ($P < 0.05$) in the scores of HDSS of both groups with mean values of 3.6 ± 0.5 for group one and 3.33 ± 0.7 for group two.

Furthermore after end of the study the mean values of HDSS score for group one was of 2.2 ± 0.7 and 1.2 ± 0.54 for group two reflecting a significant ($P < 0.05$) improvement of HDSS in group two.

Table (1): Mean value of Sweat production Pre- treatment and Post- treatment in both groups.

Statistics	Pre treatment		Post treatment	
	Group I	Group II	Group I	Group II
X±SD	13.8±2.27	13.06±1.9	9.86±2.4	4.4±1.59
Maximum (gm)	18	16	15	7
Minimum (gm)	10	10	6	2
MD	0.74		5.46	
t-value	0.95		7.31	
P-Value	0.34		0.001	
Level of significant	NS		S	

**Fig. (1): The mean value of Sweat production Pre and Post- treatment for both groups.****Table (2): Mean percentage of sweat production at the end of treatment in both groups.**

Statistics	Group I	Group II
X±SD	28.53±10.87	66.8±9.77
Maximum (gm)	50	83
Minimum (gm)	12	50
MD	-38.26	
t-value	-10.13	
P-Value	0.001	
Level of significant	S	

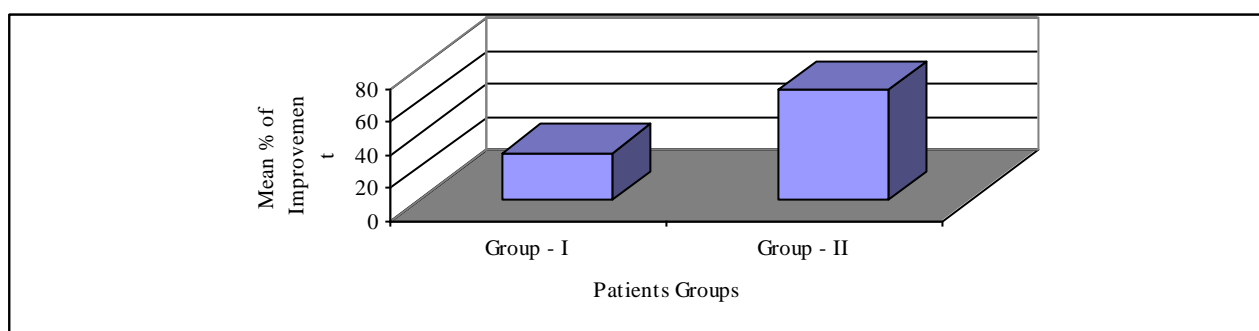
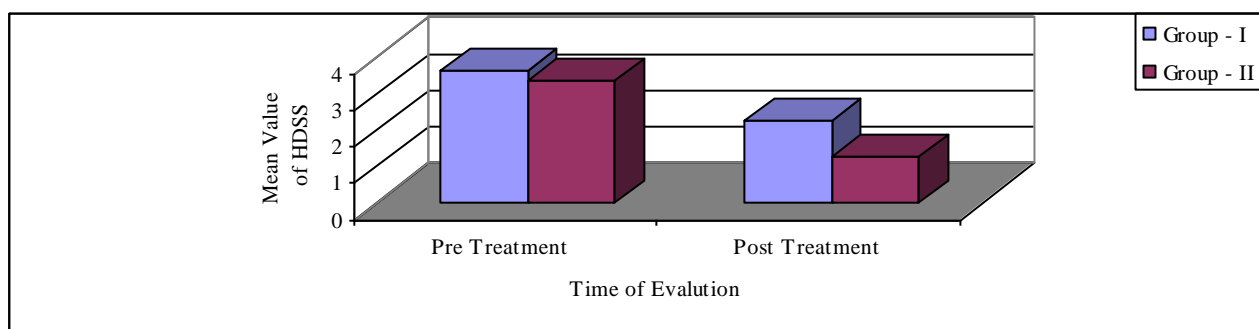
**Fig. (2): Mean percentage of sweat production at the end of treatment in both groups.**

Table (3): Mean value of HDSS Pre and Post- treatment in both groups.

Statistics	Pre treatment		Post treatment	
	Group I	Group II	Group I	Group II
X \pm SD	3.6 \pm 0.5	3.33 \pm 0.7	2.26 \pm 0.7	1.26 \pm 0.45
Maximum	4	4	3	2
Minimum	3	2	1	1
MD	0.27		1	
t-value	1.26		4.61	
P-Value	0.25		0.001	
Level of significant	NS		S	

**Fig. (3): Mean value of HDSS Pre-and Post treatment for both groups.**

DISCUSSION

This study was designed to compare the effects of Aluminum chloride hexohydrate versus tap water iontophoresis with direct current on palmer hyperhidrosis.

It was observed that results concerning sweat reduction in group two treated via tap water iontophoresis with direct current was greater than the results in group one treated by the aluminum chloride.

The results of present study are in agreements with several experimental workers; In a study by Reinauer and associates, 25 patients between 8 and 35 years of age were managed with tap water combined therapy of AC/DC compared with DC alone. A normal palmer sweating level was achieved after 11 treatments with DC. The authors reported that a combination of AC and DC "tap water iontophoresis" produced similar favorable responses⁸.

On the other hand it was reported that the use of "tap water iontophoresis" 90 V, 12 to 20 mA of DC for 20 minutes, switching polarity after 10 minutes was used to manage palmer hyperhidrosis in 18 patients. Intervention was performed 3 times a week for 3 weeks using a galvanic generator. The investigator documented reduced sweating in 15 of the 18 patients as evidenced by starch-iodine imprint⁹.

Furthermore a study was conducted using a DC stimulator for the patients with adjusting current intensity to maximum tolerable output. They used a battery-operated stimulator that provides DC for TWG. The stimulator, was used for the management of hyperhidrosis of the palms, soles, or axillae. The researchers found that, after 20 consecutive days of intervention, all 10 hands treated had decreased sweating as measured using Persprint paper and photodensitometry¹⁰.

In another study done by Karakoç 112 patients with palmoplantar s had treatment of their hands with the direct current tap water iontophoresis method. The final sweat production was significantly reduced in 81.2% of the patients. The mean time to return of symptoms was 35 days. Longer periods of remission were seen after a second period of treatment¹¹.

Unfortunately the mechanism of action of TWI is unknown, several investigators have suggested that anhidrosis due to iontophoresis results from ductal blockage without damage to the sweat glands¹².

Many authors have suggested that iontophoresis may cause a functional impairment of the sweat gland, either by completely blocking sympathetic nervous system transmission to the gland, raising the threshold for transmission of sympathetic nerve impulse, or changing the cellular secretory physiology⁵.

It was also reported that decreased pH in the sweat duct due to an increase in H⁺ ions during tap water iontophoresis may contribute to eccrine gland dysfunction¹³.

Moreover 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.

On the other hand, topic antiperspirants containing aluminum chloride are known to be first line of therapy for axillary hyperhidrosis, yet are ineffective in the treatment of Palmer or plantar hyperhidrosis because the skin is much thicker¹⁴.

Many authors have suggested that aluminum salts cause an obstruction of the distal sweat gland ducts¹⁵. A mechanism underlying this obstruction has been proposed

the metal ions precipitate with mucopolysaccharides, damaging epithelial cells along the lumen of the duct and forming a plug that blocks sweat output¹⁶.

Conclusion

The current study concluded that tap water iontophoresis using direct current was more effective as a treatment for Palmer hyperhidrosis as compared to the topical application of Aluminum chloride hexohydrate.

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الملخص العربي

عقار هيدروكسيد كلوريد الألومنيوم مقابل العلاج بتأين ماء الصنبور بالتيار الكهربائي المباشر على زيادة تعرق راحة اليد

الغرض من الدراسة الحالية هو دراسة تأثير عقار هيدروكسيد كلوريد الألومنيوم لعلاج زيادة التعرق في اليد بالمقارنة باستخدام العلاج بالتأين باستخدام ماء الصنبور والتيار الكهربائي المباشر، اشتملت الدراسة على ثلاثين شخصاً (عشرون رجلاً وعشرة سيدات) ممن يعانون من زيادة التعرق في راحة اليد وأعمارهم تراوحت من 25-35 عاماً، تم تقسيم الأشخاص عشوائياً إلى مجموعتين متساويتين المجموعة الأولى: تكونت من خمسة عشر شخصاً تلقت ستة أسابيع من العلاج باستخدام عقار هيدروكسيد كلوريد الألومنيوم يومياً لمدة شهر ثم ثلاثة أيام أسبوعياً لمدة أسبوعين المجموعة الثانية: تكونت من خمسة عشر شخصاً تلقت العلاج باستخدام التأين باستخدام ماء الصنبور والتيار الكهربائي المباشر لمدة ثلاثين دقيقة للجلسة لمدة ستة أسابيع بواقع ثلاث جلسات أسبوعياً، تم تقييم التغير في كمية التعرق باستخدام ميزان حساس وحساب النسبة المئوية للنقصان في تعرق راحة الأيدي وكذلك تم استخدام مقياس شدة التعرق في راحة اليد، تم التقييم قبل بدء الدراسة وبعد الانتهاء منها وقد أظهرت نتائج الدراسة إن العلاج بالتأين له تأثير إيجابي ذو دلالة إحصائية في نقصان التعرق في المجموعة الثانية بنسبة 66,8% وكذلك تحسن ذو دلالة إحصائية في مقياس شدة التعرق مقارنة بالمجموعة الأولى والتي تلقت العلاج باستخدام عقار هيدروكسيد كلوريد الألومنيوم والتي نقص التعرق فيها بنسبة 28,53% وعليه يمكن استخلاص مايلي: أن العلاج باستخدام التأين باستخدام ماء الصنبور والتيار الكهربائي المباشر أكثر فاعلية من استخدام عقار هيدروكسيد كلوريد الألومنيوم في علاج حالات زيادة التعرق لراحة اليد.