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The Effectiveness of Tens (Transcutaneous Electrical Nerve Stimulation) in Reducing Pain during Replacing the Dressing in Hospitalized Patients in Burn Center of Sabzevar

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Abstract

Background and aim: A burning pain is considered among the most painful conditions experienced by burn patients, specifically, during changing the wound dressing. By using complementary therapies such as aromatherapy, hypnosis, music therapy, acupressure, TENS is considered as nurses' serious tasks and has special importance in pain controlling of patients. This study was accomplished to consider the effect of electrical nerve stimulation (TENS) through skin during replacing the wound dressing in hospitalized burn patients in burn ward of Sabzevar Vasee hospital.

Materials and methods: This is a clinical trial study performed on 40 hospitalized burn patients of Sabzevar Vasee hospital in 2014. The patients were divided randomly into two groups, including control category (20 individuals) and case one (20 individuals). Before changing the wound dressing, morphine was injected to the patient, and in the second days after referral, the members of control group received placebo TENS with morphine, and TENS was received in the members of test group while replacing the dressing. Finally, after replacing the dressing, the pain of patient was measured according to pain numeric scale 0-10. The data was analyzed with Mann-Whitney tests by SPSS software (ver. 20). The significance level (p-value) in statistical tests used in this study is considered 5%.

Results: The average of pain in second day was 7.00 ± 0.56 and 5.00 ± 0.48 in control and test groups, respectively. There was a significant difference in reduction of the pain between two groups (P=0.013). It means that TENS can alleviate the pain 2.3 units more than placebo TENS.

Conclusion: Supplementary TENS and morphine are effective in reducing the pain in burn patients during replacing the bandage.

Keywords: Transcutaneous Electrical Nerve Stimulation (TENS); Burn; Pain; Bandage

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Introduction

Burning is classified as the fourth factor of traumatic events all around the world [1], as well as an obstacle in such a modern society which has irreparable side effects for the patient and his family [2]. In the United States of America about two hundred thousand people suffer from burn injuries **annually**. Among them, one thousand needs an outpatient treatment, while the rest should be hospitalized in order to be treated [3].

In Iran, around 725000 incidents resulting in burning are occurred annually [4]. A **burning pain** is classified as the most severe acute one [5]. The patients recall this pain as the most killing **discomfort** which have ever experienced [6].

Pain is a mechanism of the body, in a way that whenever a tissue hurts, the created mechanisms lead to pain [7]. This pain is not just as a result of burning, but treating actions such as replacing the wound dressing, debridement, surgery incision and physiotherapy may intensify the pain [8]. As a result of stimulation of nociceptors on the skin, pain is more sensed in **second-degree burns** [9]. Specially, this pain is more common in taking shower, the washing and replacing the dressing [10]. If can alleviate the feeling of pain in such cases, less suffering is experienced by the patient [11-13].

Pain is an unpleasant sensory experience that nurses face in clinical care [14]. As burning pain is variable and cannot be predicted completely by clinical evaluations and burning scar, it has been suggested to include drug and non-drug treats in the treatment procedure [15]. Usually **morphine intravenous** injection and narcotics are used to reduce the pain of burning. These narcotics have some side effects that the most prevalent ones including constipation, stupefaction, **drowsiness** and nausea or **vomiting** [16].

Also, narcotics disorder the private and social life of the patient [17]. Non-drug painkillers, which are used easily by families, have little side effects. Taking such painkillers along with drug painkillers may reduce the pain in such a great extent, so few painkillers will be used [16].

Transcutaneous electrical nerve stimulation (TENS) through skin is one of non-drug methods in decreasing pain, which is used from many centuries ago. For instance, it was used from electric eels in the ancient Greece to treat gout and headache [18]. For the first time this technique was suggested by Melzack and Wall expressing its effect mechanism according to gate control theory [19,20]. Moreover, TENS relieves and makes active the internal narcotic system of the body [21,22].

Simplicity, having no side effects, decreasing in taking narcotic and also being affordable are considered as the privileges of this method [23,24]. TENS is a small and programmable machine composing of an electric generator and some skin electrodes and wire. Electrodes are located on or near the pain point. They send created stimulations by machine to the skin in order to stimulate sensory nerve endings and cause feeling like throbbing or tingling [23]. TENS has been applied successfully to treat some surgeries as oral-facial surgeries, labor pain, and also has been approved by FDA [25,26].

Figure 1 A sample of a TENS device and its related leads.

As National Nursing Commission emphasized that researches on the effect of nursing interferences are in priority to prevent and reduce pain [20], replacing the dressing are considered as the first responsibilities for nurses to lessen the pain. Numerous studies on TENS and TENS placebo were accomplished to reduce severe pains showing different results. So far, no survey was performed on this matter. Therefore, it has been tried in this paper to compare the effect of TENS and TENS placebo.

Methods

This study is a randomized and clinical trial accomplished on 40 hospitalized patients of Sabzevar Vasei hospital, with second degree superficial and deep burning in distal part. Patients were classified into two groups including control (TENS placebo) and test groups (TENS) with 20 members in each one, after receiving authorization and moral code from university and with the patient's permission.

Interference was made in the second day of referral (3rd day of hospitalization) to minimize possible biases resulting from pressure and nerve stimulation. The criteria used for the selection of participants for the study consisted of patient's awareness, age (15-70 years old), burning in distal organs (4%-20%), not being pregnant, the lack of pacemaker, not suffering from cardiac dangerous dysrhythmics, not suffering from epilepsy, and not showing allergic to electrode gel.

To take part in the study

Data collection instrument was a checklist including two parts. The first part was concerned with the patient's demographic information such as age, gender, education, burning experience, etc. The second part was related to the evaluation of pain intensity in the patient. The latter was measured by pain numerical scale, including a 10-centimeter ruler in which one side shows the absence of pain (zero no.) and the other side is the maximum amount of pain can be felt (10 no.). During replacing the wound dressing, patients determine pain on the ruler by using a number from zero to ten. To determine the validity of the data collection tool, content validity was applied. In a way that after provision of checklist, the content of each question was considered and approved by Mashhad and Sabzevar faculty members. Its reliability was determined by **Cronbach's alpha** test (α=0.74).

In order to collect the study units, their qualification was approved, then their demographic information was recorded, and their pain was evaluated by considering that they were classified into two groups (control group without receiving TENS and test group as High TENS with 60-100 Hz).

After qualifying the condition of inclusion and acquisition of an informed consent from those individuals, firstly their demographic information was recorded, and their pain was evaluated by consideration of two available groups (control group without receiving TENS and test group as High TENS with 60-100 Hz).

In the first group (control), TENS device is connected and turned on, but the frequency is not given. Fifteen minutes before replacing the dressing 5 milligram morphine was injected in

Table 1 Demographic condition of hospitalized patients in burn ward of Sabzevar Vasei hospital in control .

P-value	Test (TENS)	Control (TENS placebo)	Demographic situation	
0.152	35.25 ± 3.25	38.00 ± 3.34	Age	
0.468	8.30 ± 1.14	8.95 ± 1.24	Burning (%)	
-	12	10	Female	Gender
	8	10	Male	
-	15	16	Married	Married Status
	4	4	Single	
	0	0	Divorced	
	1	0	Widow	
-	15	18	City	Place of Residence
	5	2	Village	
-	1	0	Unemployed	Occupation
	3	0	Worker	
	5	1	Employee	
	5	9	Self-Employment	
	0	0	Retired	
	4	7	House wife	
	2	3	Others	
-	2	1	illiterate	Education
	0	1	Read and write	
	5	4	Primary	
	4	7	Six courses	
	0	1	Under Diploma	
	6	3	Diploma	
	0	3	Associate Degree	
	3	0	Bachelor	
	0	0	Graduate level	

(TENS placebo) and test groups.

Table 2 The general difference in reducing pain in the first and second day of referral in control (TENS placebo) and test group.

P-value	Test (TENS) (n=20)	Control (TENS placebo) (n=20)	Group pain result
P=0.013	6.90 ± 0.39	6.60 ± 0.47	Pain in the first day of referral (Mean ± SD)
	5.00 ± 0.48	7.00 ± 0.56	Pain in the second day of referral (Mean ± SD)
	1.90 ± 2.10	0.40 ± 1.56	The difference between experienced pain in the first and second day after referral

vein and leads of TENS machine were adjoined in 5-centimeter distance from burning scar. After passing 10 minutes, the dressing was washed and then it was replaced. When patient's condition was constant, pain range was measured and recorded in 0-10 numerical scale.

In the test group, devices are connected to the organs and frequency is also given until a feeling of tingling can be felt in the relevant member. Like the first group, 15 minutes before replacing the dressing 5 milligram morphine was injected in vein and leads of TENS instrument were adjoined in 5-centimeter distance from burning scar to the patient. After passing 10 minutes, the wound was washed and then replaced, impulse was created, and dressing was replaced when the instrument was turned on, and 60-100 Hz frequency and tingling were observed in the patient. Finally, when patient`s condition was constant, pain range was measured and recorded.

6-channel TENS device with TENS MED 420 model made by Arman Pouya Company in Iran in 38.7`C water and in 27°C temperature was used in order to prevent tremble in the patient. Confounding factors such as ambient air temperature and water temperature, which can create bias, are explained in this section. To analyze the data, descriptive and inferential statistics were used. It was found out by Shapiro-Wilk test that some of data were not distributed in a normal way. Therefore, it was used from Mann-Whithney test to compare pain in two groups. Demographic variants (such as age, gender, job, and education) from Mann-Whithney and Fisher exact tests were used to control homogeneity between groups. Significance was considered below 0.05.

Results

The findings of the research indicated that 55% (22 individuals) of the study units were men, 35% were self-employed and 27.5% of the members had a primary education, with the highest prevalence. Most of the study units were married (77.5%) and lived in the city (82.5%).

As **Table 1** represents, the average age of control and test groups was 38.00 ± 3.34 and 35.25 ± 3.25, respectively. Additionally, there was no significant statistical difference in age variant (P=0.152). Also burning percentage of study units was 8.95 ± 1.24 and 8.30 ± 1.14 in control and test groups, respectively, thus they were homogeneous and there was no significant statistical difference in burning percentage (P=0.468).

According to **Table 2**, the average pain intensity of the study units were 6.60 ± 0.47 and 6.90 ± 0.39 in control and test groups, respectively, hence there was no significant statistical difference in pain (P=0.612) (in the first day of referral to hospital was decreased and morphine was only used before replacing the dressing in order to reduce pain) **(Tables 1 and 2)**.

Discussion

The study results showed that most of the patients were less than 36 years old, probably as a result of cooking in house for women and working in dangerous conditions by men. The study of Manzari point out that the average age of burn patients was 32.23 ± 9.71 years [27], while this average was 40.1 ± 5.3 in the research of Naderi that it coincides with the present study.

It was found out in the survey of Farahani that 42 (76.4%) and 35 individuals (63.6%) were married in control and test groups, respectively (P=0.14). In the present study 31 (77.5%) of the study units were married, which this is in consistent with our study.

Such high percentage in burning among married people may be due to doing routine affairs of married families at home (females) and outside of home and workplace (males).

In the current paper, most of the study units had primary education with frequency of 19 individuals (31.7%).

Therefore, lack of awareness and education in precaution activities and ways to prevent burns can be a key factor in burning events. In this case also the above-mentioned study concords with the present paper.

The study of Farahani showed that 44 individuals (80%) in control group and 41 individuals (74.1%) in test group lived in cities. In this study, 33 members of study units (82.5%) lived in cities, which it coincides with the present study. Population density in cities compared to rural areas, and also relatively easier access to heaters and warm foods in cities can be a vital factor in percentage of burning in cities [28].

The results of this study revealed that despite of interfering, in the first day of referral pain increased from 6.60 ± 0.47 (TENS placebo) to 7.00 ± 0.56 in control group in the second day. While pain decreased in test group (TENS) from 6.90 ± 0.39 in the first day of referral to 5.00 ± 0.48, it means than pain has been decreased as 1.90 ± 2.10 units. In other words, on average pain decreased 2.3 units more than placebo group (TENS) after referral in comparison to the first day, therefore there was a significant difference statistically (P=0.013).

The magnitude of the pain in the control group (TENS placebo) has been increased from 6/6 ± 0/47 on the first day visiting up to 7 ± 0/56 on the second one, when the intervention has been carried out (0.4 ± 1.56 units rising), while such values were 6.9 ± 0/39 and 5 ± 0/48 on the first and second days in the test group (TENS) (1.9 ± 2.1 units falling) **(Figure 1)**.

In the research of Erdogan, that assessed the effect of electrical nerve stimulation through skin to control pain after Tracheotomy, the average of pain was shown to be 3.5 and 5.5 in TENS and placebo TENS groups, respectively. Such difference was statistically significant (P=0.009) [29].

In another study by Heffernan as "the effect of electrical nerve stimulation through skin to control acute pain after surgery" the time of requesting for a painkiller in TENS group was longer than control group, that such difference was statistically significant (P=0.01) [30].

In the paper of Lander, which was done on the effect of TENS on pain resulting from venous injection in children, control group had the most pain while the least pain was observed in the members of TENS group. Such difference was also statistically significant [20]. Smeltzer and Bare asserted that TENS blocks pain control pulp by stimulating A-β thick nerve fibers in posterior horn of spinal cord, and then reduces pain [14].

Joybari evaluated the effect of electrical stimulation for reduction of the pain resulting from stomach surgery in 7-12 children. In that study, the Mann-Whitney tests did not show a significant statistical difference in decreasing the pain in test and placebo groups (P=0.48) [31].

As stomach is a vast organ and there are many nerve fibres and cells in it, and it is not possible that all of these nerves to be covered by TENS, and also as children in this age may have not a real comprehension about pain, therefore there are different reports on their pain. Moreover, a theory on decreasing pain by applying TENS points out that possibly there are numerous factors in experiencing pain so electrical stimulation is not known as an effective method in reducing pain [32].

In another research by Benedetti as "Pain controlling in thorax after surgery with different methods" TENS was applied on 324 patients. The results showed the effectiveness of this method only with little to medium pains after surgery, and it was not helpful to reduce excessive pain [32]. In both groups, small and great surgeries on thorax have been accomplished. It was observed that TENS was useful in surgeries with a small cut in thorax, but not so effective in surgeries with big incision.

Conclusion

Although above studies point out different results on applying electrical stimulation through skin on the patient, the results of this study showed the effectiveness of TENS in reducing pain during replacing the dressing in burned patients. Therefore, by training the nurses in burn unit of the hospital on applying such

stimulation, pain in the burned patients can be reduced in an extent range. Also, it is suggested to compare TENS and TENS placebo in other parts of the body.

Conflicts of Interest

The Authors have no conflicts of interest.

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