

Research Article**Comparing the effect of Acticoat (TM) dressing and dressing with phenytoin cream on the healing process of pressure ulcer****Maryam Zakizadeh^{*1}, Marziyeh Asadizaker²****Simin Jahani³ and ⁴Amal Saki Malehi**¹Department of Nursing, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

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²Department of Nursing, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran³Department of Nursing, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran⁴Department of Biostatistics and Epidemiology, School of Public Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran**ABSTRACT**

Background and purpose: pressure ulcer is a type of injury which requires the diagnosis and primary care by nurses in hospitalized patients, which not only delays recovery but also imposes high costs on patients and their families. The most important method used to deal with them is the use of dressing. The type of dressing has a significant effect on the level of healing. That is why this study was performed to compare the effect of Acticoat dressing (modern dressing) and phenytoin cream (traditional dressing) on the healing process of pressure ulcers.

Materials and methods: this single-blind clinical trial was performed on 40 patients with pressure ulcer grade 2 and above at Shahidzadeh hospital in Behbahan city, Iran. The patients were selected based on the inclusion criteria and divided into the two groups of patients with Acticoat (TM) dressing and those with phenytoin cream dressing. The data collection tool in this study, included a demographic information questionnaire and also the Pressure Ulcer Scale (PUSH) for healing. Every week for three weeks, the wounds were examined and their PUSH scores were determined. By comparing the PUSH scores in both groups, a wound's status was evaluated. The data were analyzed using the SPSS software.

Results: no significant statistical difference was seen in the wound (tissue) color of the two groups. However, a significant statistical difference was seen in the size, amount of exudate and average total (healing) points of the wounds.

Conclusion: Acticoat (TM) dressing accelerates pressure ulcer healing more than phenytoin cream does. Consequently, given its availability and cost effectiveness, it can be used as a common treatment in the healing of pressure ulcers.

Keywords: Acticoat (TM), phenytoin sodium cream, healing, pressure ulcer

INTRODUCTION

In recent years, something that has become an important concern in health centers across the world among medical staff especially nurses, is the problem of pressure ulcers development in patients who, for any reason, have to stay longer in bed in hospitals or at home, especially in a state of complete immobility, anesthesia or

decreased consciousness level (1). Despite improvements in the quality of health care around the world, the number of patients with pressure ulcers has increased (2). In terms of the prevalence of pressure ulcers, 70% of these injuries occur in people over 70 years of age, 60% in hospitals, 18% in elderly care centers

and the remaining at home (3). According to the European Pressure Ulcer Advisory Panel (EPUAP), its prevalence in western countries was reported as being 8% to 33% (4). In Iran, the percentages of the prevalence of pressure ulcers were reported as being 13.6% for patients with acute care, 42.1% for patients with long-term care and 0%-17% for home care (3). About 50% of pressure ulcers occur due to a lack of proper care and prolonged duration of stay in hospital which lead to increased hospital costs. By increasing the amount of septicemia and bacteremia, pressure ulcers increase the mortality rate of patients (5). The annual cost of pressure ulcer treatment in the UK National Health Service ranges from 1.2 to 1.4 billion pounds and in the USA it ranges from 5 to 5.8 billion dollars. (6, 7).

Given the importance of the subject and also considering the time and cost considered for it, if proper treatment can be used to deal with these wounds, many problems can be eliminated and instead of caring for pressure ulcers and their symptoms, the vital issues of patients can be taken care of (8). Today, various methods such as health care and skin care to maintain its coherence, the use of protective equipment and patient education as a method of prevention, dressing with honey, fish oil, fibroblast growth factor, laser therapy and the use of negative pressure are used to prevent and treat pressure ulcers (6 and 9-12). Most of these methods have relative effects and are complementary in the treatment of pressure ulcers (10). For this reason, to treat this injury, effective treatments which are more convenient and easier for patients to tolerate are needed with one of the most common one being the use of dressings.

Dressing replaces the skin epithelium that has been lost due to damage. Dressings are used to protect the wound against microbial contamination, enhance wound healing by absorbing the wound exudate and debridement and keep the wound moist (13).

Traditional dressings used in the treatment of pressure ulcers included dressing with phenytoin cream. Phenytoin probably affects the wound through several mechanisms including reduced inflammation, formation of connective tissue,

collagen preservation and anti-bacterial activity. By increasing estrogen, this medicine causes increased fibroblast division which consequently results in accelerated healing. One of its advantages is its low cost, but the topical administration of phenytoin causes pain and burning sensations and does not create a moist environment for wound healing (14).

One of the modern dressings in the treatment of pressure ulcers, is Acticoat(TM) dressing that contains silver ion and is used to provide a moist environment, prevent bacterial growth and accelerate the healing process of pressure ulcers (16). The dressing absorbs wound exudate, causing pain relief for patients, and its other benefits include, convenient use and reduced frequency of dressing change and the disadvantages of it include a high cost and some of its possible side effects include allergy (allergy to silver) (17). Roberts et al. in a study conducted on the comparison of Acticoat(TM) and Elion dressings, stated that Acticoat(TM) is more effective in wound healing and saving nursing time and resources (18). Also a study performed by Gravant et al. which was conducted on patients with burns, revealed that the patients using Acticoat(TM) dressing experienced less pain and infection compared to those using traditional silver-containing dressings (19). Acticoat (TM) is one of the modern dressings in wound treatment. Most studies performed on this type of dressing were performed on patients with burns, or animals, and no study has ever been performed to evaluate its effectiveness on pressure ulcers.

Phenytoin as sodium phenytoin cream 1% is used for the treatment of pressure ulcers but its effect on the healing of pressure ulcers is not clear and various studies suggested to do more studies to measure its effect on pressure ulcer. At the location of the study, these two types of dressing are widely used for the treatment of pressure ulcers. So the researcher tried to perform a study to compare the effect of Acticoat (TM) dressing and phenytoin cream dressing on the healing of pressure ulcers in patients hospitalized in Shahid Mostafa Shahidzadeh hospital of Behbahan city.

MATERIALS AND METHODS

Based on the objectives and nature of the research, this study is a single-blind two group trial performed in 2015 in Shahid Mostafa Shahidzadeh hospital, Behbahan city, Khuzestan province. The researcher received permission from the Ethics Committee of Ahvaz University of Medical Sciences and Health Services of Jondi Shapoorin southwest Iran, and a written permission from the faculty of Paramedical of Behbahan, and then selected 40 patients (the number of samples in this study were calculated according to a pilot study) with grade 2 and higher pressure ulcer who met the research inclusion criteria (age must be over 18, no consumption of immunosuppressive drugs, no consumption of drugs and cigarettes, their hemoglobin and albumin levels must be in the normal range, should not have any severe chronic disease such as cancer, diabetes and cardiovascular disease which affect the process of wound healing).

In order to observe ethical issues about the research purpose, methods of research, the research safety and arbitrariness of continued participation in the research, conversations were held with the patients (if patients were not conscious then their first degree relatives were talked with) and their permission was received for continued participation. In this study using simple random sampling, the subjects of the study population were placed in two groups (using random allocation table) including those using acticoat(TM) dressing and those with phenytoin dressing (the common dressing of the hospital for pressure ulcer). In practice, sampling was gradual. This means that the first 20 patients who enrolled in the study were randomly allocated to one of two groups then the sampling was continued; each subject whose status was equivalent to the status of someone already included, would be placed in the opposite group. The two groups were homogenized in terms of age, gender, ward, body mass index, mobility, location and degree of pressure ulcer. The subjects were treated only with the type of dressing they were aware of and did not know about the existence of any other type of dressings. If before the second week, one of the

subjects died, was unwilling to continue cooperation or required surgery debridement, he/she would be excluded and replaced with another subject. One of the subjects of acticoat(TM) group died in the third week who remained in the study. It was explained to patients and their family that the project director will be responsible for compensation of possible side effects.

Demographic information questionnaire and PUSH were the data collection tools in this study. The demographic information questionnaire included: age, gender, ward, body mass index, wound, alertness, mobility, hemoglobin and serum albumin. By using the PUSH, three criteria including wound area, exudate level and the type of body tissue formed in the wound were evaluated and scored.

In the dressing with phenytoin cream, the wound was washed once a day by the researcher with normal saline solution and dried with sterile gauze and after the use of phenytoin sodium 1% cream on the entire surface of the wound, due to the size of the wound, one or more sterile gauze dressings were placed on the wound. In case of a dressing getting separated when a patient's sheets or clothes were changed or in case of the dressing getting wet due to high exudate, the dressing would be placed again as was instructed. Acticoat (TM) dressing was also used once every 3-5 days as follows: every day, first the pressure ulcer was washed with distilled water and dried with sterile gauze, then the dressing was cut to the size of the wound and placed on it, also, the dressing was moisturized everyday using distilled water.

Dressing changes for female and male patients were performed by female and male nurses respectively. The nurses were trained and coordinated with one another on how to change dressings. The wounds were examined in a specific hour every week after removing the old dressing and before placing a new one. Using the PUSH, every week to three weeks, the characteristics of the wound were evaluated. In order to prevent any scientific and practical bias, in several of the wounds, the PUSH score of both nurses were compared with each other. When releasing each patient, a phone number

was provided to them for follow-up examinations and the healing process was tracked at home. The patient or the caregiver were told to call the researcher through the provided phone number in case anything including fever, symptoms associated with allergies and sensitivities, high exudation, smelly and inflamed wound appeared in the patient. The dressing was kept on the skin for 3-5 days and if anything like high exudation, smelly and inflamed wound happened, the dressing was replaced regardless of the time of dressing change. The required instructions on position changing, diet, health habits, etc. were given to the patients and or their caregiver.

Because the follow-up period of the patients was long, there was a possibility that some changes might occur in their nutritional status, type of activity and alertness level which contradicted their primary information. Therefore, based on the fact that during 3 weeks, what nutritional method, type of activity and alertness level a patient had experienced the most, their most frequent statuses were considered for them. Wound status during three subsequent weeks in the two groups were compared with each other. Also, the weekly changes in the wounds during

these three weeks were individually checked in each group. The data were analyzed using SPSS version 21, Chi-Square test, Mann Whitney test and analysis of variance for repeated measures.

FINDINGS

The mean and standard deviation of age in the Acticoat™ and phenytoin groups were 53 ± 18.04 and 54 ±18.59 respectively. The mean and standard deviation of body mass index (BMI) in the Acticoat™ and phenytoin groups were 25.045±2.46 and 25.35± 2.46 respectively. The majority of the wounds in both groups were in the sacral region. Patients hospitalized in ICU constituted the greatest percentage of the total number of patients in both groups. Pressure ulcers had a greater frequency in individuals with a BMI of 25-30.85% of the patients in both groups were completely immobile and 15% had relative mobility. Also, frequency of grade 2 wound was higher in both groups. At the beginning of the study (week 0), in terms of wound status (area, level of exudates, type of tissue), there was no significant statistical difference between the two groups (p> 0.05) (table 1).

Table 1: Specifications of the study units in terms of age, gender, location of the wound, wound grade, ward, mobility status and BMI

	Acticoat	Phenytoin	Pvalue
Gender			
Female	5	5	1
Male	15	15	
Wound location			
Sacrum	20	20	1
Shoulder	0	0	
Heel	0	0	
Ward			
ICU	10	10	1
Internal	7	7	
Surgery	3	3	
Mobility status			
CBR	17	17	1
RBR	3	3	
Wound degree			
Grade 2	14	14	1
Grade 3	5	5	
Grade 4	1	1	
Mean age ± SD	18.04±53	18.59±54	1
Mean BMI ± SD	2.46±25.04	25.35± 2.46	1

Table 2: Wound status at baseline in the two groups

Condition of the wound	Type Group	Week zero (baseline)	P-value
The area of the wound	Phenytoin	13.84 ± 28.80	0.08
	Acticoat	13.86 ± 32.29	
Color of the wound	Phenytoin	0.44 ± 2.25	0.70
	Acticoat	0.41 ± 2.20	
amount of exudates	Phenytoin	0.75 ± 1.40	0.78
	Acticoat	0.82 ± 1.45	
wound overall score	Phenytoin	1.53 ± 13.15	0.18
	Acticoat	1.35 ± 13.45	

Table 2 shows there is no significant changes between the two groups in the baseline condition of the wound. By using an analysis of variance for repeated measures it was discovered that mean changes of the wound area (size) in the Acticoat group during weeks 0 and 1 (P=0.001), 1 and 2 (P=0.001) and 2 and 3 (P=0.000) had significant statistical differences.

It was also discovered that mean changes of the wound area (size) in the phenytoin group during weeks 0 and 1 (P=0.001), 1 and 2 (P=0.000) and 2 and 3 (P=0.000) had significant statistical differences.

Score

Figure 1: Comparison of the mean score of wound area from inclusion into the study until the end of it in both groups

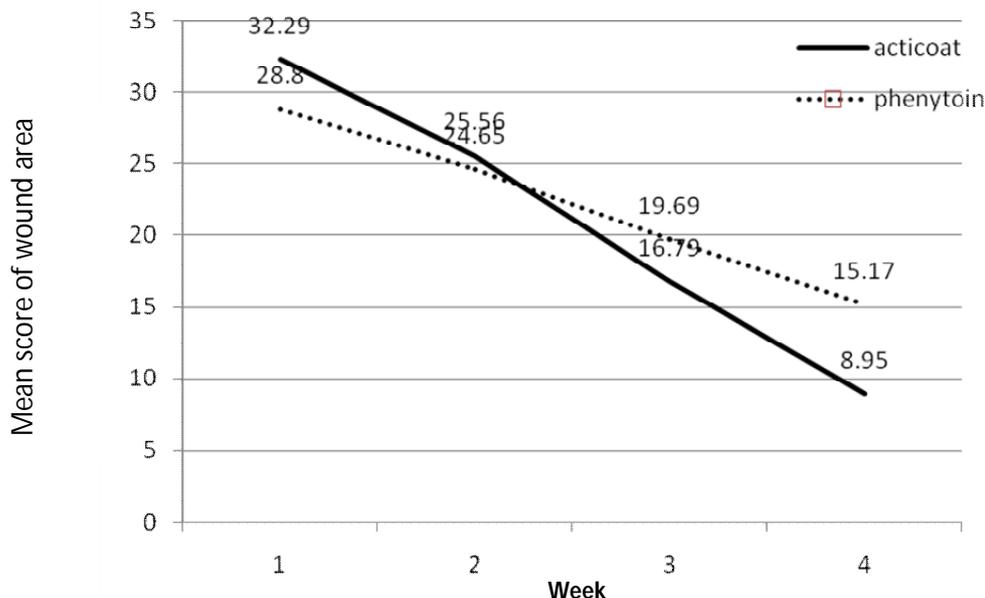


Figure 1 shows that in the Acticoat group dressing, reduced PUSH scores related to mean score of wound area relative to phenytoin, clearly decrease faster and healing situation is better and mean difference between groups is statistically significant (P=0.029).

By using an analysis of variance for repeated measures it was discovered that mean changes of the wound drainage in the Acticoat group during weeks 0 and 1 (P=0.008), 1 and 2 (P=0.001) and 2 and 3 (P=0.025) had significant statistical differences.

It was also discovered that mean changes of the wound drainage in the phenytoin group during weeks 0 and 1 (P=0.008), 1 and 2 (P=0.001) and 2 and 3 (P=0.025) had significant statistical differences.

Figure 2: Comparison of mean levels of exudates from inclusion until the end of the study in both groups

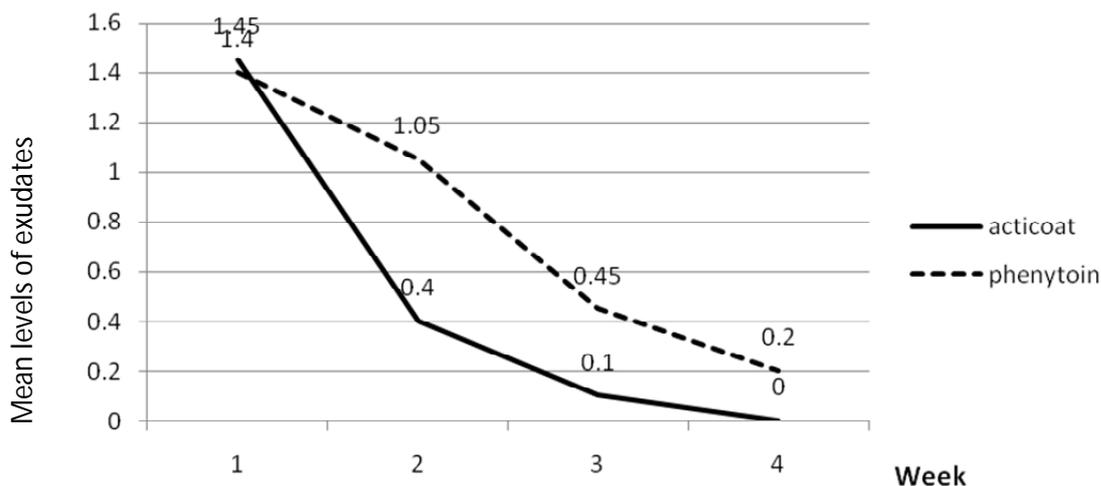


Figure 2 shows that in the acticoat group dressing, decreased PUSH scores related to mean exudate level were clearly greater and the healing process is better compared to the phenytoin group, and that also significant statistical differences are seen between the mean wound area scores of both groups ($P=0.037$). By using an analysis of variance for repeated measures it was discovered that mean changes of the wound color (tissue type) in the Acticoat group during weeks 0 and 1 ($P=0.000$), 1 and 2 ($P=0.000$) and 2 and 3 ($P=0.000$) had significant statistical differences. It was also discovered that mean changes of the wound color (tissue type) in the phenytoin group during weeks 0 and 1 ($P=0.000$), and 1 and 2 ($P=0.005$) had significant statistical differences but the statistical differences were not significant during weeks 2 and 3 ($P=0.083$).

Figure 3: comparing the means scores of wound tissue type since inclusion in the study to the end of it in both groups

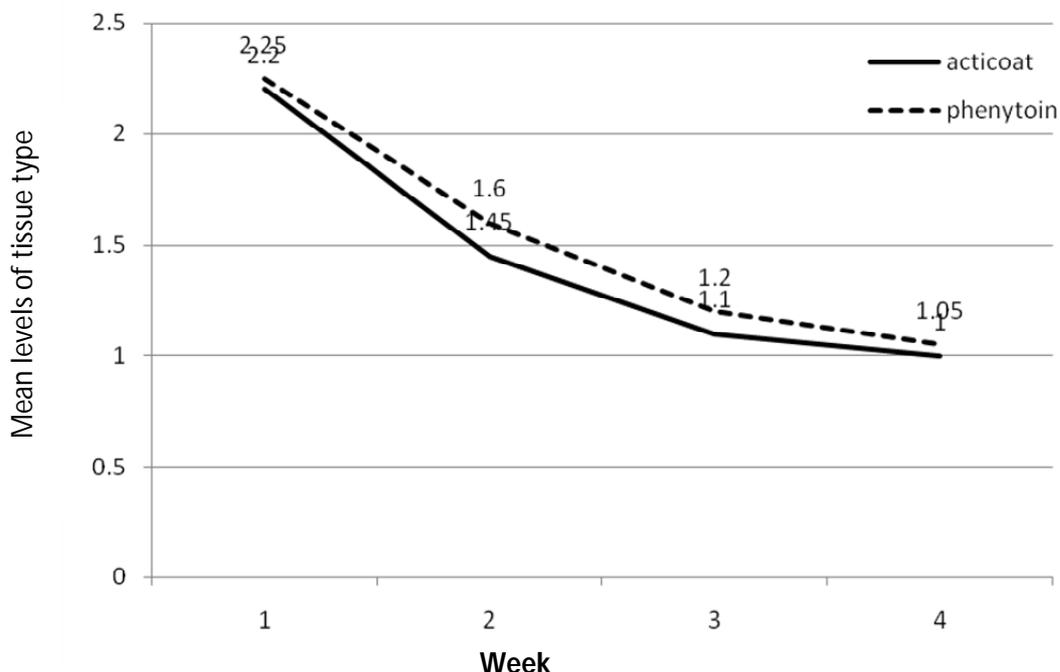


Figure 3, shows that the slope of decreased PUSH scores related to wound color (tissue type) in both groups are almost equal. And there is no significant statistical difference between the mean wound color scores (tissue type) of both groups ($P=0.163$).

By using an analysis of variance for repeated measures it was discovered that mean changes of the wound overall score in the Acticoat group during weeks 0 and 1 ($P=0.000$), 1 and 2 ($P=0.000$) and 2

and 3 ($P=0.000$) had significant statistical differences. It was also discovered that mean changes of the wound overall score in the phenytoin group during weeks 0 and 1 ($P=0.000$), and 1 and 2 ($P=0.000$), and weeks 2 and 3 ($P=0.000$) had significant statistical differences.

Figure 4: comparison of the mean wound (healing) scores from inclusion until the end of the study in both groups

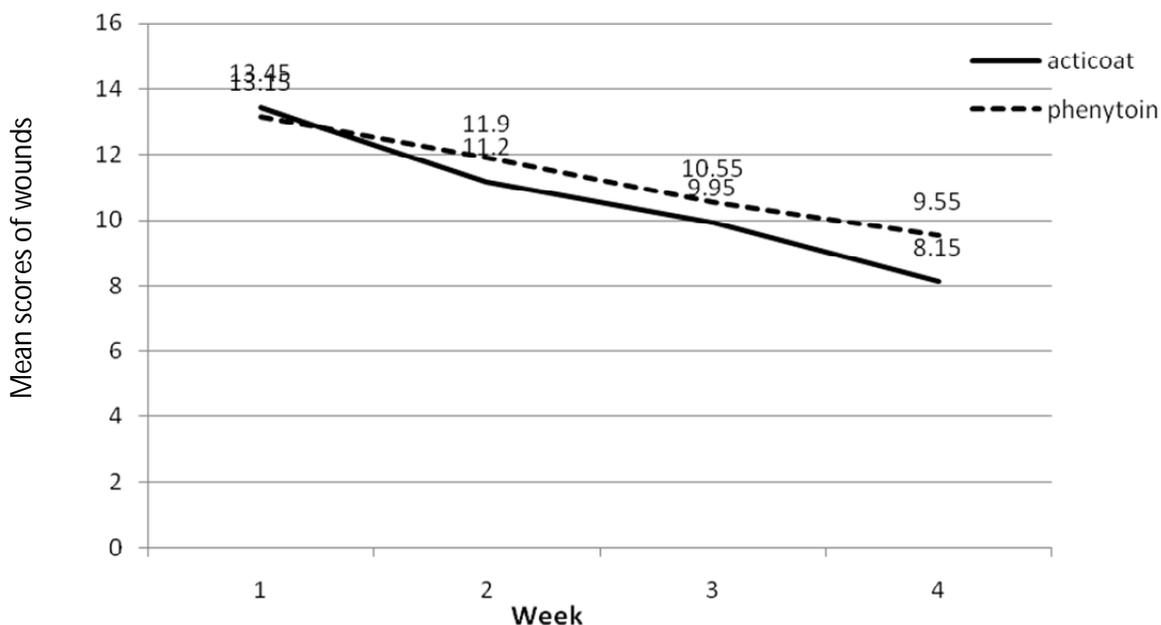


Figure 4 shows that in the acticoat group, the decrease in the PUSH score related to the mean wound score relative to the phenytoin was quicker and the healing status was better and a significant statistical difference is seen between the mean scores of the wounds of both groups ($P=0.005$).

DISCUSSION

In the present study, there is a significant difference between the mean scores of the wound area of both groups ($P=0.029$). In the Acticoat™ group, the decrease rate of the PUSH score related to the wound area mean scores, is clearly faster and the healing process is better. In a study performed by Arikan et al. (2013) on the open wounds of a rabbit, it was observed that the wound area in the Acticoat group compared to the creatine hydrochloride and control groups, significantly decreased ($P<0.01$) (20). In a study performed by Sangupta et al. (2015) on the open wounds of albino rats, the mean decrease in the wound area in the 20th day of the study in the phenytoin group was 157.9 ± 3.3 (8.88%) (21), and in the simple gauze bandage group was 105.8 ± 7.259 (4.59%) which was statistically significant ($P<0.001$) (21). In a study performed by Sobana et al. (2007) on pressure ulcers, the wound area in the phenytoin group was higher than that of the control group, but it was statistically

insignificant (22). Riahi et al. (2009) performed a study on pressure ulcers and concluded that phenytoin has a greater effect on decreasing wound area compared to honey but the difference was not statistically significant ($P>0.05$) (23). Between the means scores of the level of wound exudates of both groups, no significant difference was seen ($P=0.037$). In the Acticoat group, the decrease rate of the PUSH score related to the mean score of wound exudates, is clearly faster and the healing is better. In a study performed by Khondkar et al. (2010) on burn wounds, they concluded that Acticoat compared to other available silver dressings, has a greater antibiotic effect (24). Thomas et al. (2013) observed that the antibiotic effects of Acticoat dressing are greater than those of Actisorb, Evans and CounterIt-H and that they better destroy microorganisms like gram negative, gram positive bacteria, and fungi compared to others (25). In a study by Friz et al. on battle wounds, it was discovered that dressings containing silver, decrease wound

exudates and eliminate the bad smell of wounds (26). Huang (27), Gravent (19), Castlano (28), Ledink (29) and Gago (30), in their studies showed that Acticoat has greater antibiotic effects and patients who use it suffer less wound infection. Between the mean scores of wound color (tissue type) of both groups, no significant statistical differences were seen ($P=0.163$). The downward slope of the PUSH score decrease related to wound color (tissue type) in both groups is almost equal. In a study performed by Bord et al. (2007) on the open wounds of a rat, it was observed that dressings containing silver (Acticoat and CounterIt-F), delay wound epithelialization (31). Ledink et al. observed in their study that dressings containing silver including Acticoat, AQUACEL-Ag, CounterIt-H and Ounce, are cytotoxic and decrease the proliferation of keratinocytes (29).

In a study performed by Mojib et al. (2015) on diabetic foot ulcers, it was observed that the amount of granulation in the phenytoin and simple gauze bondage groups were 92.94% and 54.64% respectively, which is statistically significant ($P<0.0001$) (32).

In Singopta's study it was observed that phenytoin decreases epithelialization time which compared to the control group was statistically significant ($P<0.05$) (21). Leo et al. (2003) observed that granulation levels in a diabetic foot wound in the phenytoin and control groups were 87.94% and 74.64% respectively which were not statistically significant ($P>0.05$) (33).

Between the mean overall scores of the wounds, a significant statistical difference was seen ($P=0.005$) and in the Acticoat dressing group, the decrease slope of the PUSH score related to the mean of the overall score of the wound was steeper and the healing process was better. In a study performed by Gago et al. (2008) on infected wounds, it was observed that Acticoat, compared to AQUACEL and Comfeel ($P=0.042$), heals the wounds faster (30). In a study performed by Miller et al. (2010) on infected wounds, it was observed that there is no significant statistical difference in the healing level of the wound when Acticoat or Yedisorb dressings are used, but silver dressing did better at healing older and bigger wounds (34). In

Huang et al.'s study, it was observed that the healing percentage in the Acticoat group in day 15th of the first treatment day was 37.97% which was greater compared to the control group (silver sulfadiazine cream) but was not statistically significant (27).

In Riahi's study it was observed that phenytoin compared to honey, makes healing faster but the differences are not statistically significant (21). In Sobana's study also the decrease in the PUSH score of the pressure ulcer in the phenytoin group was higher than that of the control group but was not statistically significant (22). Halisaz et al. (2004) concluded that in grade 1 pressure ulcers, healing degree with hydrocolloid dressing was better than simple dressing ($P<0.005$) and phenytoin ($P<0.05$) but in grade 2 wounds, the healing was better with hydrocolloid compared to the simple dressing ($P<0.005$), but it did not have a significant statistical difference with phenytoin ($P>0.05$) (35).

In the group receiving Acticoat dressing, the decrease slope of the PUSH score related to wound area and amount of exudates during the study weeks was steeper which showed that Acticoat, decreases the area and amount of wound exudates compared to dressing with phenytoin cream sodium but the wound tissue type in both groups is almost equal and the decrease slope of the PUSH score in both groups is equal. The score decrease slope related to the overall wound (healing) score in the Acticoat group was steeper and the healing status was better.

A significant statistical difference was seen between the mean of overall wound (healing) scores of both groups ($P=0.005$). This issue shows that Acticoat dressing, accelerates pressure ulcer, which is in alignment with the study results of researchers such as Gao, Miller and Huag. The researcher thinks that the increased healing in the Acticoat group can be due to this dressing's effect on the high absorption of exudates, moisturizing of the wound area. The researcher thinks that its high antibiotic effects are caused by silver ion release.

CONCLUSION

Given that this dressing helps save time and costs and accelerates the healing process, it can be used in health centers and hospitals in the future to treat pressure ulcers.

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