

Research Article

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The application of moist dressing in treating burn wound

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Abstract: Basic experiments have demonstrated that the effect of wound healing in moist environments is better than that in dry environments; therefore, research on moist dressing is the focus of wound healing research. 42 burn patients receiving treatment in Jiangsu Provincial People's Hospital were selected as experimental cases. Wound surface is divided into treatment group and control group using a self-contrasted method. The treatment group received a moist dressing in the treatment of burn wounds and the control group adopted iodine gauze or Vaseline gauze coverage. Wound healing effect and the impact on the degree of pain of in the two different treatment methods were observed after treatment. The results of 42 patients were included in the analysis. The average healing time of patients' burn wounds in treatment group is (10.9 3.3) d, and the average healing time in control group is (13.8 3.6) d, so, the difference is significant ($P < 0.01$). Wound pain in the treatment group is significantly lower than that in the control group ($P < 0.01$). Using moist dressing (Mepitel and Mepilex, etc.) in the treatment of burn wounds, wound-healing time can be shortened and wound pain can be reduced significantly.

Keywords: Moist dressing, Slight burn wound, Wound healing, Pain

1 Introduction

Burns are a type of skin injury common to life. Due to the different degrees and environmental conditions of burns, the treatment methods are also different. In 1962, the British zoologist Winter, in his study on formation rate and cicatrization of young pigs' superficial epithelium, found

that the rate of epithelialization is twice as fast when covering pigs' wounds with a polyethylene film, which first confirmed that a moist and permeable wound dressing can accelerate wound healing processes, therefore, the study of moist dressing is raising more and more concern [1]. The application of moist dressing aims to reduce the patients' pain and improve the wound microenvironment. This helps to promote wound healing without interfering with the normal anatomy and wound-healing environment. In this paper, it has been shown that using moist dressings to treat burn wounds has resulted in relatively satisfactory clinical results at the Jiangsu Province People's Hospital.

2 Case analysis to treat burns with moist dressing

2.1 Object

42 patients, with second degree burns, were selected in Jiangsu Provincial People's Hospital, 20 males and 22 females, aged 5-55 years with an average age of 38.5 years, among which there were 2 patients with gestational diabetes mellitus and 5 patients with deep second degree burn. The smallest wound was about 4cm×3cm and the biggest wound was about 24cm×17cm. In order to make the wounds of unified standards and high comparability, self-control method was adopted to measure patients' wounds, which means that the selected patients all have two or more wounds. A wound was marked as the treatment group, another wound was marked as the control group, and the wounds' depth and area were roughly the same.

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent: Informed consent has been obtained from all individuals included in this study.

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2.2 Treatment

In the research, silver ion moist dressing was provided by Swedish Molnlycke Health Care and was used as the experimental moist dressing. Treatment group treatment: Cleaned the wound with saline, cut the damaged epidermis free, directly covered broken skin with moist dressings and fixed with bandage or wide tape. On the third day, the wound was opened, blisters with a diameter >2cm were drawn out, loose floating epidermis were cut, and the wound continued to be covered with a moist dressing bandage. Control group treatment: Cleaned the wound with saline, covered the wound with type III Anerdian gauze, blisters of diameter >2cm were drawn out, after two or three days, cover with Vaseline gauze and bind up with gauze bandage.

2.3 Obvervational index

1. After the first five days of burn treatment, observe wound healing 1 time/d. According to wound healing standard epithelialization, wound-healing time of the two groups is observed after treatment. 2. According to visual analogue scale as the standard for pain score: 0 is painless; 1-3 is patients' relatively slight pain; 4-6 is patients' pain that can still endure disrupting sleep; 7-10 is patients' strong pain difficult to endure. With methods in the two groups observed after treatment, the degrees of pain at different times were given scores and the effects of two treatment methods on wound pain were compared.

2.4 Statistical analysis

All the data were analyzed with statistical software SPSS19.0; the measurement data were shown by $\bar{X} \pm S$. By using t test, $P < 0.05$ means the difference is of significance and $P < 0.01$ means the difference is of great significance.

2.5 Treatment effect: The comparison of degree of pain scores in treatment and control group are as follows

Treatment group: 1d,3points, 2d, 5points, 3d, 1point;
Control group: 1d,7points, 2d, 5points, 3d,3points.

comparing the effect of moist dressing treatment group and oil gauze dressing control group on wound healing time						
Group	wound healing time					
	5-8d	9-11d	12-14d	15-17d	18-20d	20d +
treatment group	4	23	8	4	3	0
control group	2	10	11	13	5	1

T test and its result on the initial data in two groups					
Paired samples Statistics±					
		Mean	N	std. Deviation	std. Error Mean
Pair 1	treatment group	13.8333	42	3.64201	0.56197
	control group	10.8571	42	3.28761	0.50729

Figure 1: Comparing the effect of moist dressing in treatment group and oil gauze dressing in control group on the wound healing time.

Paired Samples Test									
		Paired Difference							
		Mean	std. Deviation	std. Error Mean	95% confidence interval of the difference		t	df	sig.(2-tailed)
					lower	upper			
					Pair 1	treatment group - control group			

Figure 2: The number distribution.

2.6 Scores of degree of pain comparison in the same treatment time the two groups.

Pain score in the treatment group is significantly lower than that in the control group ($P < 0.01$), the difference is of great significance.

Comparing the effect of moist dressing in treatment group and oil gauze dressing in control group on the wound healing time, the healing time and number distribution were as follows in Figure 1 and Figure 2:

It can be seen from the T test result that the average wound healing time after moist dressing in treatment group is (10.9 ± 3.3) d, and the average wound healing time after oil gauze dressing in control group is (13.8 ± 3.6) d. The difference of the two groups is of great significance.

3 Types and treatment mechanisms of moist dressing

3.1 Types of moist dressing

Moist dressing can be divided into several types according to different materials [2].

1. Hydrogel moist dressing: wound hydration, crust malacia and autolysis debridement.
2. Alginate moist dressing: exudate absorption, slight hemostasis and antiphlogosis.

3. Silver ions moist dressing: antimicrobial resistance, anti-infection and exudate absorption.
4. Foam moist dressing: granulation overgrowth prevention and epithelization acceleration.
5. Hydrocolloid moist dressing: wound regulation and stimulation of granulation tissue growth.
6. Mesalt moist dressing: exudate absorption, antiphlogistic, detumescence, bacteriostasis, sterilization and wound cleaning.

3.2 Clinical Indications of Moist Dressing

In recent years, moist dressing is mainly used in the treatment of refractory and infective wounds, including diabetic foot ulcer, venous ulcer of lower extremities, recurrently infected pressure sores, atherosclerotic aortic ulcer and traumatic ulcerations. Moist dressing has been widely used and achieved good results in the treatment of these diseases.

After years of clinical application and summary of experience, moist dressing has gradually expanded the application scope of treatment, for example, it has been used for infection of incisional wound after operations, phlebitis, donor site wound surfaces, wound of abscess incision drainage, wound surface of anal fistula surgery, necrotizing fasciitis and dermal radio lesions, which has achieved good curative effect. But it still needs further research to apply moist dressing in the treatment of wound caused by squamous cell carcinoma, immunological diseases and hemorrhagic disease. Specifically, the clinical application indications of moist dressing include the following aspects:

Hydrogel moist dressing is applicable when the wound has black scabs for the sake of moisturizing effect. Hydrogel moist dressing and mesalt moist dressing are applicable when the wound has rotting flesh. Silver ions moist dressing is applicable when the wound has rotting flesh accompanied by infection. Mesalt moist dressing, alginate moist dressing, hydrophilic fiber moist dressing and silver ions moist dressing are applicable when the wound has a cavity with much exudate. Hydrogel moist dressing and mesalt moist dressing are applicable when the wound has full-thickness wound of granulation. Mesalt moist dressing is applicable when the wound has granuloma. Silver ions moist dressing and foam moist dressing are applicable when the wound granulation is too long [3].

3.3 Theoretical basis of moist dressing's effect on promoting burn wound healing

Theories of moist dressing's effect on promoting burn wound healing include wound healing in moist environment, autolyzed debridement, drainage nourishment, minimally invasive or noninvasive to reduce scar formation.

Wound healing in moist environment theory refers to the promoting effect on wound healing in the environment of moderate moisture retention, anaerobic or hypoxia, subacidity and autolyzed debridement. Environment of moderate moisture retention can promote the release of growth factors, stimulate cell proliferation, promote growth factor and receptor binding, promote mobility of immune cell and accelerate skin cell migration.

Environment of anaerobic or hypoxia can stimulate macrophages to release growth factors and oxygen gradient stimulates angiogenesis of hair cells. In the state of hypoxia, the growth of fibroblasts is most ideal. Skin is acidulous, which is the ideal environment of wound healing, and closed wound environment is also acidulous, namely the PH is 6.4 ± 0.5 , but the PH of open wound environment is higher than 7.1. Collagen is a basic building protein, which is also the main element of the granulation tissue. Generally, fibroblast cells produce collagen in acid environment.

Environment of autolyzed debridement is to apply moist dressing to hydrate wound and soften necrotic scab skin with the lysine produced by phagocyte and neutrophilic granulocyte contained in the drainage dissolving the necrotic cells. The autologous enzyme in the wound can also liquefy the deactivation organization. Each dressing exchange is a removal of necrotic cells so as to clean the wound. This process is called autolysis debridement.

Drainage nourishment theory: electrolyte, nutrients, inflammatory mediators, leukocyte, digesting enzyme and growth factors are rich in a closed wound drainage, which can prevent the wound from drying. Drainage can also stimulate cell proliferation in the healing of the wound, in which digesting enzyme occurs in inactive form. In the undesirable healing of wound, drainage has an opposite effect; on the other hand, it contains a lot of inflammatory transmitters and active digesting enzymes. Drainage can also help the tissue repair cell locomotion, provide the nutrition for the cell metabolism, promote the diffusion of growth factor and immune factor and help to dissolve necrotic cells and injured tissues [4].

In the uninfected wound, exudate can promote the growth of fibroblasts, endothelial cells and cutin cell. Except for overmuch exudate or infection, proper

treatment should be given. It is traditionally believed that all the exudate is useless, and much exudate is caused by bacteria increase or apparent infection, so dressing seems to have no effect, which runs counter to the actual effect of moist dressing.

4 Effect and manifestation of clinical application of various moist dressings in the treatment of burn wound

4.1 Effect and manifestation of clinical application of alginate moist dressing

Alginate moist dressing is algae acid extracted from seaweed, which is a kind of insoluble polysaccharide soft non-textile fiber similar to cellulose and contains 85% natural alginate fiber and 15% hydroxymethyl cellulose sodium. Alginate moist dressing is produced as follows: A biodegradable algin similar to gel reacts with calcium chloride to produce silk fiber mixing in a certain sequence to make 2-mm alginate dressing in compression.

Calcium salt is produced in the process, which has strong absorbency and absorptivity is 20 times more than its own quality. It can effectively control the percolate and form soft moist gel-like coagulum to have ion conversion with exudate, in which the insoluble calcium alginate turns into soluble sodium alginate with calcium ions released at the same time, so it has hemostatic function [5]. To prolonged use of dressing also can form a more stable mesh-structured layer on the surface of the wound and separate the wound from the outside world. With a closed anaerobic environment formed, the hyperplasia of new capillary can be accelerated and a moist environment can be maintained, thus, it enhances regeneration ability of skin cells and accelerates mobility of epidermal cells, which is conducive to blood clotting.

Alginate moist dressing has the following features:

1. Good air permeability, non-toxic, no stimulation and no antigenicity.
2. Effect of mechanical compression hemostasis and clotting promotion.
3. Reducing the loss of water, salt and nutrients on the surface of the wound.
4. Restricting bacteria to grow on the surface of the wound.

5. Keeping the moist environment on the surface of the wound to promote epithelial growth.
6. Easy carrying and using.

Compared with traditional dressings, alginate moist dressing causes a lower risk of infection mainly because of its hermetically sealed material. It also can promote the local blood vessel hyperplasia and increase the blood supply, so, the treatment effect is improved.

4.2 Effect and manifestation of clinical application of hydrogel moist dressing

Hydrogel moist dressing is to use hydrogel in penetrate materials (not sure what is trying to be said in this previous sentence). Hydrogel is produced as follows: A kind of hydrophilic swelling material, with the joint forces of hydrophobic grouping and hydrophilic residue, connects the water molecules inside the mesh, and the hydrophobic residues bond cross polymer in water. It is composed of collagen, gelatin, hyaluronic acid and fibrous protein, whose moisture content can be up to 96% [6].

The surface of hydrogel moist dressing is smooth with good biocompatibility which can keep moist environment on the surface of the wounds. It hydrates with the tissues it contacts and at the same time absorbs wound percolate.

Due to the temperature of hydrogel, moist dressing is only 5°C, which can play a role in the cooling of wounds and reduce pain and inflammation after treatment.

Compared with Vaseline gauze dressing, hydrogel dressing has a good effect on burn treatment.

4.3 Effect and manifestation of clinical application of silver ions moist dressing

Silver ions moist dressing is a kind of antibacterial dressing through absorption and coverage, which are made of soft hydrophilic polyurethane foam and membrane with elasticity and permeability. Due to the electrostatic adsorption to the cell surface and accumulation in the cell, and the combination of protein and DNA, it also has photocatalytic bactericidal effect.

The silver ion dressing is made by means of adding silver compounds on the basis of the hydrocolloid dressings, which can release silver ions constantly and effectively for 1 week. It also creates moist environment when absorbing exudate, which is suitable for the prevention and treatment of all kinds of refractory wounds [7].

4.4 Effect and manifestation of clinical application of foam moist dressing

Foam moist dressing is provided with porous structure to absorb liquid of great capacity and increase the permeability of the oxygen and carbon dioxide. Composite materials include polyethylene butyl aldehyde, polyurethane, polyurethane and vinyl, etc. It controls exudate with vapour flowing and absorption mechanism. Supplementary material can be made into all kinds of thickness, which has good protective effect on wound surface due to its strong thermal insulation and moisturizing ability and enables patients to feel more comfortable due to its light dressing material. Foam structure can prevent dressing from moist healing environment. Waterproof and antibacterial foam expand rapidly after absorbing exudate and keep dressing in good contact with the bottom of the wound. Foam with medium-aperture has good capillary effect and can ensure full contact with the wound due to its unique role in the negative pressure drainage. Rapid drainage and vertical absorption will lock exudate in fixed area without impregnating surrounding skin. Foam moist dressing's service cycle can be up to 5-7 d, which is mainly used for medium exudate in various stage of wound healing and superficial wound free from infection [8].

4.5 Effect and manifestation of clinical application of other moist dressings

Nanosized silica is a kind of new biological materials with micropore on its surface, which has strong skin permeability and antibacterial property and can effectively prevent and eliminate the occurrence of wound infection and promote wound healing. Nanosized silica antibacterial dressing not only has the good curative effect in the treatment of burns, but also has good effect in the treatment of chronic ulcer and other infected wounds.

The antibacterial mechanism of nanosized silica dressing is to block the respiratory enzyme through bacterial cell membranes and combine with the negatively charged bacteria protein through the slow release of silver ions, in which bacteria protein can become denatured and sedimentary, resulting in inhibition of enzyme activity and excessive matrix metalloproteinases on burn wound. Nanosized silica dressing has extensive sterilization and antibacterial effect and scarcely causes drug resistances. But nanosized silica dressing is not in a widespread use due to its high cost. In addition, the biological mechanism of nanosized silica dressing has yet to be further research [9].

5 Conclusion

In the clinical application of moist dressing, it is confirmed to be effective in the treatment of burn wounds, which can shorten wound-healing time and relieve pain. It can be used in any part of the body and enables patient's to feel comfortable during treatment. So, in spite of the higher price, moist dressing is still applicable to be used in clinical treatment of burn wounds because of its good curative effect in the healing process of wound and patients' degree of comfort.

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