

Research Progress in Dressing Selection for Diabetic Wound Healing

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Abstract: Diabetes and its complications are among the important factors affecting the physical health of the middle-aged and elderly people in China, and diabetic wounds are one of them. Diabetic wounds are incurable and easily not easily controlled by recurrent infections. In the treatment of diabetic wounds, the use of wound dressings is one of the most important means, so selecting a rational dressing is essential for the treatment of diabetic wounds.

Keywords: Diabetic wound healing, Wound dressing, Research progress.

1. Introduction

Diabetes is a debilitating and highly prevalent disease, and according to 2021 statistics, diabetes currently affects approximately 1 million 368 thousand Chinese people, representing an increase of 2.8%. Diabetes mellitus is the eighth leading cause of death in China, and Medicare spends approximately 61 million RMB on diabetes annually, and the medical cost of diabetes mellitus is also higher for the individual patient. Diabetic wound ulceration versus non healing is a significant complication of diabetes, with significantly higher medical costs associated with wound non healing in people with diabetes compared with the general population. Treating wounds that do not heal or are difficult to heal is also a key issue that is being addressed by health care systems worldwide. Published studies have shown that the development of chronic wounds from a traditionally cultured phenotype of planktonic growing microorganisms to a complex and diverse biofilm phenotype is a key contributing factor to the retarded wound healing process. Rational selection of dressings based on the concept of biofilms is therefore a new idea to promote diabetic wound healing.

2. Traditional Wound Dressings

Current wound dressings are diverse, and the adapted wound states are not the same, and the advantages and disadvantages and characteristics of common wound dressings are listed one-to-one below. Traditional wound dressings usually consist of cotton pads or gauze, and the dressings are directly in contact with the wound, which can maintain the cleanliness of the wound and have a certain air permeability. But do not have moisturizing, antibacterial and other functions, and do not promote wound healing are gradually eliminated. Low adhesiveness dressings, which are mainly made of plain gauze wound dressings infiltrated with paraffin or paraffinlike materials, have low adhesiveness for the wound and can protect the wound. It is inexpensive, safe and nontoxic and not prone to allergic reactions, but its ability to absorb water in general is not very similar to the evaporation rate of water from the skin, and water is easily lost. More serious infections are caused by easy invasion of bacteria after the exudate of diabetic wounds is soaked. However, this can be improved with liquid absorbent

dressings, which can effectively reduce the effective amount of wound exudate through the adsorption of adsorbent materials and reduce off flavors, pain, impregnation, and infection of the wound, as well as reduce the number of dressing changes. There are also transparent membrane dressings milked into the market, which are usually constructed of highly polymeric materials such as polyethylene, polypropylene, polyurethane, polylactic acid, etc., and are suitable for securing indwelling needles or catheters or are ordinary outer layer dressings. It is able to block the invasion of microorganisms in the outer environment into the wound, prevent cross infection to a certain extent and can reduce the scar after wound healing to a certain extent. Air and water molecules can pass freely, enabling water exchange in near physiological states while facilitating observation of wound healing. But the transparent membrane dressing cannot be applied to moist wounds because it has little ability to absorb the osmotic fluid.

Foam dressings are mainly composed of polyurethane foam and polyethylene foam with water absorbency. It is indicated for the prevention of pressure injury, wounds with medium to large amount of oozing fluid, and wounds with excessive granulation. Studies have shown that foam dressings can promote diabetic wound healing and maintain a low infection rate, and no delay in wound healing after drug loading of foam dressings has been found in experiments where foam dressings were loaded.

Hydrogels, water cells, and hydrocolloid dressing classes are composed of water and nonadherent polymolecular polymers. This class of dressings cool the wound, relieve pain, piggyback on drugs that limit local extravasation while providing a hydrated environment that keeps the wound moist, promotes necrotic tissue dissolution, provides effective wound debridement and is easily cleared. Meanwhile the hydrogel dressing can piggyback on active substances such as growth factors to promote diabetic wound healing to promote diabetic wound healing. Its ability to promote complete healing of diabetic wounds is comparable to that of common dressings. Hydrogels are generally more effective than basic wound contact dressings for the treatment of diabetic foot ulcers.

Odor absorbing dressings, which are processed from activated carbon fibers, can effectively adsorb wound exudates and wound off flavors, destroy the environment for bacterial growth, and have a certain anti-inflammatory and

hemostatic effect, some added with seaweeds and hydrophilic fibers can increase the absorption capacity. However, alginate dressings with alginate as the main constituent showed desirable properties in terms of water absorption, equilibrium water content, swelling index, water vapor transmission and evaporative water loss, and reasonable drug and polymer distribution when piggybacking on the drug. The dressing is transparent and convenient to observe the wound and can be cut into the required size, has good biocompatibility with human primary skin keratinocytes, and is relatively safe for both healthy skin and wound neof ormation tissue. Collagen dressings since collagen is the basis of wound healing and skin formation, collagen containing dressings may be useful in the treatment of diabetic foot ulcers. There are studies demonstrating higher complete healing rates and faster healing rates with collagen dressings compared to ordinary foam dressings.

Many current dressings will also choose to piggyback on specific drugs, often for diabetes treatment and anti infective functions, to allow drugs to be absorbed and act through the wound to achieve the goals of treating diabetes, promoting wound healing, or preventing infections.

3. Smart Wound Dressing

Traditional wound dressings used in the treatment of diabetic wounds do not directly monitor wound healing or frequent dressing changes with controller drugs often lead to secondary infection of the wound. In contrast, emerging multifunctional smart wound dressings can reduce the frequency of dressing changes. For the treatment of chronic wounds, the research and application of smart wound dressings can greatly reduce patients' pain and medical burden. Currently, observation of the wound surface is only possible after the dressing is opened, or with auxiliary tools such as infrared thermometer, infrared imager to observe changes in the wound microenvironment. Smart dressings formed by combining biosensors with dressings not only possess the essential functions of traditional dressings, but also can observe the microscopic changes such as temperature, pH value, blood glucose concentration, microbial status, oxygen content, etc., on the patient's wound surface without opening. Dressings. Then converted into visual data for monitoring. In this way, the wound microenvironment becomes transparent and controllable. Each microindex will be controlled within a set range. This method is advantageous for maintaining a wound environment suitable for healing. It can help diabetic foot wound healing. In addition, the monitoring of wound microenvironment also contributes to the optimal release rate of different drugs. For example, when ciprofloxacin hydrochloride is loaded, the highest continuous release rate of ciprofloxacin hydrochloride can be obtained if the use of smart dressings can effectively monitor and control the microenvironment under acidic conditions. Encapsulation of antimicrobial drugs such as ciprofloxacin and fluconazole in water-soluble fibrin suspensions by alphnsa et al. Cross binding with thrombin forms drug loaded fibrin nanoparticles. The release rates of ciprofloxacin and fluconazole were different under different pH conditions. The potential for controlling infections in diabetic foot ulcers is substantial. In addition, some smart dressings have both controlled and controlled release functions. They can release drugs for long periods of time, thus reducing the frequency of dressing changes, which is a widespread concern in recent years. Timing, quantification and local drug release can reduce the

number of dressing changes, increase compliance and improve efficacy. Antimicrobial drugs such as quinolone containing silver wound dressings typically release silver ions in a sustained manner. Dressings combined with biosensors can achieve controlled release of drugs according to changes in the wound environment. For example, smart hydrogel dressings can monitor the microenvironment of the wound surface and adjust the drug release under different spatiotemporal conditions according to changes in the microenvironment.

In addition to the aforementioned novel dressings, the new multifunctional nanofibrous scaffolds fabricated by electrospinning technique are characterized by high specific surface area and porosity. They are also well suited for skin tissue engineering. For example, patterned fibrous scaffolds can structurally mimic the multistage structure of natural ECM, provide support for cell growth, and effectively promote diabetic wound healing.

4. Conclusion

With the development of diabetic wound dressings, the healing situation versus the post healing situation has improved significantly, and with the development of materials and pharmaceuticals, we have reason to believe that the development of diabetic wound dressings will usher in more leaps.

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