

Clinical Evaluation of an Absorbent Hydrogel Dressing on Burn Wounds

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Presented at:
Second Asian Pacific Burns Conference
Hong-Kong
February 9, 1996

Abstract

Twenty patients with second degree burns (> 10% TBS) were treated with an absorbent hydrogel dressing. About 65% are deep second degree wounds and only 10% have serious overall third degree burns. The rest are a mixture of all degrees. The standard treatment of burns in our hospital has been covering with Silversulfadiazine Cream (SSD) and dry gauze, but since we know that the Silver Ions in the cream are irritating to the tissue, we have chosen a new standard treatment in our hospital. SSD has the potential to preserve viable dermal tissue but the epidermal regeneration is rather slow and irritated, while the formation of granulation tissue is pronounced with an abundance of myofibroblasts. This abundance of myofibroblast is a possible cause of hypertrophic scars. Our new standard treatment begins with killing the germs on the burned skin with SSD, but then we cover the wound with large pieces of hydrogel without SSD. In the first days these hydrogel sheets can be left for at least three (3) days. As wound exudate diminishes the hydrogel sheet can be left for one (1) week or longer. Wound healing is enhanced and patient comfort is dramatically improved compared to the old standard SSD/gauze. We have had no signs of infection during the treatment with the hydrogel. Histopathological evaluations of wounds treated with the hydrogel will be compared to other burn treatments and discussed on cellular and histological outcomes.

Introduction

Clinical evaluation of an absorbent hydrogel dressing on burn wounds. Within a period of six (6) months, twenty (20) patients with second degree burns (more than 10% total body surface) were treated with an absorbent hydrogel dressing. From those, thirteen (13) patients had deep second degree burn wounds and two (2) of them had serious overall third degree burns. The rest were a mixture of all degrees.

Standard Treatment

The standard treatment of burns in our setting has been; covering the wounds with Silversulfadiazine Cream (SSD) and dry cotton gauze. The Silversulfadiazine Cream was applied two or three times a day after removal of the remnants.

The wound healing pattern for the SSD treatment is by most humans the same. Histopathological investigation of the wound (done by the Beverwijk Burns Research Institute, The Netherlands) shows a typical mixed aspect of eschar with granulation tissue and outgrowing epithelium. Disintegration of the crust starts after approximately one week post burn at the wound edges. Re-epithelization, starting from the edges, can be seen very soon.

After some time, depending from the surface, approximately 14 days, the epidermis broadens and a not expected and not explainable pseudocarcinomatous outgrowth appears. This seems typical with SSD and without consequences. Histopathological data show that silver ions are irritating the tissue. As long as the scab exists, the ions stay at the top of this scab. There they are disinfecting the wound without penetrating the scab. As soon as the scab breaks down, the ions get absorbed and can be traced in the blood. When re-epithelization is completed, you will find more or less severe hyperkeratosis. (= Epithelium cells that keep on growing with a thickening of epithelium and the formation of pellets. It seems to be a normal reaction of the body to the treatment.)

Silversulfadiazine has the potential to preserve viable dermal tissue but the epidermal regeneration is rather slow and irritated, while the formation of granulation tissue is pronounced with an abundance of myofibroblasts. Abundance of myofibroblasts is an indication of overactivity with greater chance of hypertrophic scarring (too much collagen production). The abundance is caused by secondary inflammation inside already healed tissue. The remnants of hair follicles in the tissue become surrounded by silver ions with an inflammation as a result. This abundance of myofibroblast is a probable cause of hypertrophic scars. These histological data are the result of the investigation of Dr. Hoekstra a.o., who did an evaluation of SSD on a burn wound model in the New Yorkshire pig.

Since we thus know that the silver ions in the cream are irritating to the tissue, we have preferred a new standard treatment in our clinic.

New Standard Treatment

Our new standard treatment begins with killing the germs on the burned skin with SSD, but then we cover the wound with large pieces of hydrogel (*Elasto-Gel™*, Southwest Technologies, Inc.) without SSD. *Elasto-Gel™* consists of 65% glycerin, 17.5% water and 17.5% poly-acrylamid that acts as matrix. The first days these hydrogel sheets can be left for at least one to three days. As wound exudate diminishes, the hydrogel sheet can be left for one week or longer. Wound healing is enhanced and patient comfort is dramatically improved, compared to the old standard SSD and cotton gauze.

Until now we have not had any sign of infection during the treatment with the hydrogel. The reason for no infection should be sought in the high concentration of glycerin in the dressing. Glycerin is not a fast anti-bacterial product but by blocking all bacterial growth, the concentration of germs remains very low.

An investigation of The University of Miami School of Medicine, Department of Dermatology and Cutaneous Surgery, shows that *Elasto-Gel™* is effective in reducing both the number of *Pseudomonas Aeruginosa* and the total number of bacteria (normal skin and gram positive flora) when compared to both DuoDERM® and ClearSite® dressings. *Elasto-Gel™* treated burns had a comparable number of *Pseudomonas Aeruginosa* as air exposed burns. This suggests that *Elasto-Gel™* occlusion does not favorably support *Pseudomonas Aeruginosa* proliferation and may have significant implications for clinical use. The decrease in bacteria count for the air exposed wounds was expected since *Pseudomonas Aeruginosa* favors a moist environment for proliferation.

We also know that the hydrogel absorbs the wound exudate, but at the same time it forms a small layer on the surface of the wound – a jelly clot – with a high concentration of growth factors and proteins. Because the healing resulted macroscopically in the absence of hypertrophic scars even three months after complete epithelization, histopathological evaluation of a wound treated with this hydrogel probably will show no abundance of myofibroblasts.

Investigation with local therapeutics, to which in higher concentrations glycerin is added, shows a decrease of inflammation. In higher concentrations this can lead to slower healing of the wound. The dressing cannot dry out and does not stick to the wound. (It does not stick to wet surfaces but it sticks mildly to dry surfaces.) It absorbs the wound exudate and there is no maceration of the surrounding tissue. The gel is saturated when you see uneven swollen parts at the upper layer of the dressing. The dressing, for reasons of long term application, is very cost-effective. According to Billingham and Medawar glycerin is not toxic.

Case Reports

First case is a chemical burn. A man working in the chemical industry burned both his hands, upper legs and part of his face with a chemical solution. His hands were treated with the New Standard Treatment.

Second case is a lady that burned her leg, hands and part of the abdomen.

References

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