Electrospun nanofibers improve wound healing & scarring in epidermolysis bullosa : a case study from a parents perspective

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Introduction

The patients is an 18-month girl suffering from Recessive Dystrophic Epidermolysis Bullosa (RDEB), a genetic disease characterized by the faulty expression of collagen VII, resulting in extreme skin and mucosal fragility. Blistering and erosions form in response to minor trauma or friction.
Patients with RDEB often suffer from delayed wound healing, atrophic scarring, relapsing and chronic wounds. As most other children with RDEB this patient was treated at home.

In this work, the potential of on-the-spot, personalized electronspun healing fibers for improving wound healing was studied through the use of the Spincare™ wound system.

Spincare™ is a portable and easy-to-use electrospinning device, which enables in-situ 3D printing of a nanofibrous polymer matrix onto wounds, providing a transparent and flexible skin sustitute until full healing of the skin, after which it spontaneously peels off.

Performance Indicators

During healing:
- size of wound area
- amount of exudate
- occurrence of bleeding
- occurrence of infection
- pain level

After healing:
- redness and mechanical properties of the scar
- time to relapse
- quality of the new skin

Method

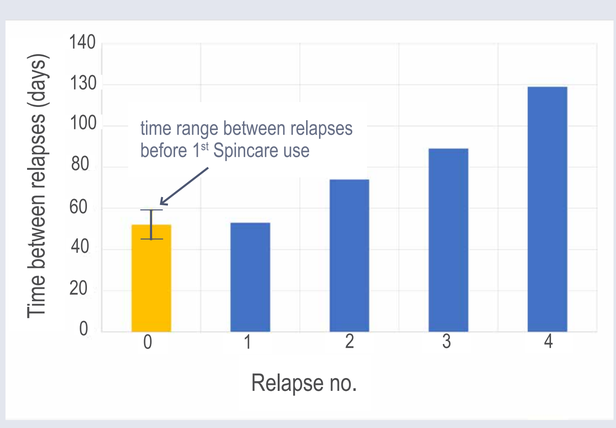
Only eroded or partially-eroded wounds were treated with Spincare™.
Prior to application, wounds were soaked in a bath and cleaned with soap and water. Eventual loose epidermis was cut off with scissors. After Spincare application, Mepilex Transfer was applied as a secondary dressing, (with the exception of “hard-to-dress areas” e.g. face and neck which were not covered with a secondary dressing). The Spincare matrix and secondary dressing was left in place for an average of three days until the next bath. (Before we started using Spincare we needed to perform dressing changes every or every other day due to the amount of exudate coming from the wounds). An adhesive remover was sometimes used in the bath to help remove the secondary dressing. Spincare was reapplied if there was uncertainty of matrix still being present. If the wounds seemed dry no secondary dressing was used. Instead, a moisturizer was applied twice a day.
Photos were taken at every dressing change.

Results

During healing: On average, complete healing of the wounds occurred in seven days. Exudate levels were generally low before Spincare application, and decreased to scant afterwards. There was no increased bleeding and only one suspected wound infection. Pain does not seem to be an issue for the patient.
After healing: Once healed the structure of the skin tissue seemed stronger and less prone to breaking down. Most scars (i.e. redness and/or modified skin texture) completely disappeared after a few months. Areas of the skin that had recurrent wounds every 6-8 weeks relapsed more seldomly after being treated with Spincare.

Decrease in RELAPSE FREQUENCY in areas prone to reccurring wounds

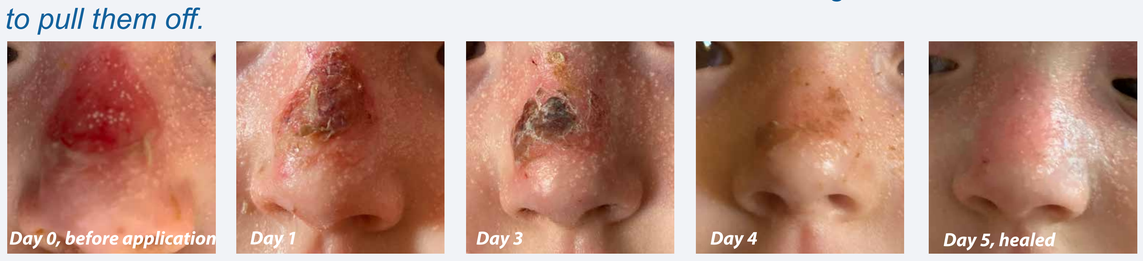
Example: case of a ~25-cm² wound on the inner left thigh (left), initially formed a few days after birth and reopening every 6-7 weeks since. The repeated use of Spincare™ allowed for less frequent and overall less severe relapses (right). Experience is still ongoing.



Traumatic injury with loss of skin on the inner left arm. This was an early case where photo documentation was performed on a daily basis resulting in daily dressing changes. Mepilex Transfer was removed with the help of a silicon adhesive remover. On day three the patient chose to spend a longer time in the bath Spincare was reapplied. You can see the matrix beginning to peel off at day eight. Completely closed with good skin integrity within two weeks.

A few examples of hard to dress areas that healed without scarring. No cover dressing were used on any of these wounds.

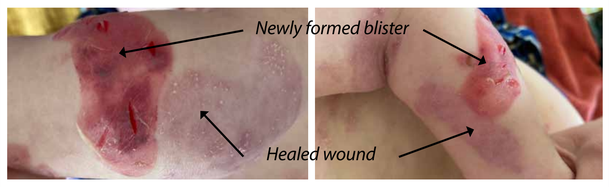
Traumatic skin loss over the nose. Difficult area to fixate dressings as the child tends to pull them off.



Traumatic skin loss over the neck caused by ribbons under her hat.

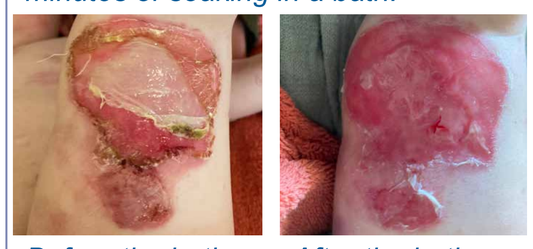
Head injury caused by tripping while crawling. Almost impossible to fixate dressings in this area but Spincare gave an excellent protection.

Spincare treated skin seems to have increased resistance and was less prone to break down. The examples below shows the left elbow from differents sides.



The lighter purplish patches show the wounds that healed a month ago. The darker red area is a newly formed punctured blister. Note that the new blister does not progress into the newly healed areas which is quite unusual.

Spincare physical properties help prevent infection. Should they occur it is no problem to remove the matrix, it comes off naturally after a few minutes of soaking in a bath.



Before the bath. *After the bath.*

Discussion

Spincare gave us a feeling of empowerment towards handling the patient’s EB condition. We no longer feared the situation when we see a new wound, because we know that within five to ten days it’s going to be behind us. We let Spincare handle the wound without changing it between twice weekly baths and there is no need to as the amount of exudate is negligible. And a few months after healing, the scar is gone which is another significant benefit. Dressings do not need to be changed as often as other solutions. Without Spincare we would not be able to handle the EB condition as efficiently. Another benefit is the product is battery powered and fits in a small handbag to allow efficient transport and use. Spincare has proven to be our best treatment option in our fight against EB. Thank you so much to the people who worked hard to make Spincare available to the market: it does change lives, not only those of EB patients but also those of their families and caregivers.

References

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