

## THE USE OF HYALOMATRIX IN DEEP PAEDIATRIC BURNS

**Tamisani A.M.**

Istituto Giannina Gaslini, Genoa, Italy

**SUMMARY.** Burns therapy has gradually evolved over the last few years, and now we have at our disposal biotechnology and synthetic materials that are absolutely innovative. Hyaff is a new product composed of a hyaluronic acid ester; hyaluronic acid is a substance naturally occurring in the basal layer of the epidermis together with proliferating keratinocytes. For some three years in the Surgical Emergency Unit of the Giannina Gaslini Institute in Genoa we have been using Hyalomatrix in deep second- and third-degree burns. Hyaluronic acid certainly plays an important role in the processes leading to tissue repair: the inflammatory process, granulation tissue formation, and re-epithelialization. Hyaluronic acid is metabolized by the liver. On coming into contact with the exudate of the wounds, it jellifies, cleaning the wounds, softening the eschar, and obliging the collagenous fibres to permit good spontaneous healing. Hyalomatrix does not require daily medication, its removal is completely atraumatic, and it can remain on the wound for three or four days, depending on the seriousness of the case.

### Introduction

Burns therapy has gradually evolved in the last few years: now we have at our disposal biotechnology and synthetic materials that are absolutely innovative. In the treatment of deep burns, it is necessary to reconstruct the dermal structure as soon as possible, in order to favour adequate repair and effective functional recovery of the burned area. We now have Hyalomatrix, a new skin substitute composed of hyaluronic acid.

Hyalomatrix is a skin substitute composed of two layers. The internal layer is a three-dimensional dermis-like matrix consisting of fibres of a hyaluronic acid ester called Hyaff, while the external layer is a flexible and transparent elastomer film that operates as a semi-permeable barrier to external agents. The transparency of the elastomer film makes it possible to monitor the evolution of the underlying wound without removing the medication.

### Materials and methods

Hyaluronic acid is one of the main polysaccharides of the extracellular matrix. It was first discovered in the vitreous humour of the eye and was later also found in the synovial liquid in the skin and other organs and tissues. It has certain particular features: it is hygroscopic and visco-elastic. These features turn out to be important for the healing of wounds in general and of the skin in particular.

Hyaluronic acid plays an important role in the processes leading to tissue repair: it influences phagocytizing activity, stimulating the migration of phagocytizing cells, and stimulates the proliferation of fibroblasts and angiogenesis.

Hyaff is an ester of hyaluronic acid obtained from the esterification of hyaluronic acid with benzyl alcohol. Hyaluronic acid and benzyl alcohol are released through hydrolysis of the ester bond.

Hyaluronic acid is metabolized by the liver, just as the natural form is. Benzyl alcohol, oxidized to benzoic acid and combined with glycine in the liver, produces hippuric acid and is eliminated through the renal emunctory.

Hyaluronic acid remains in the wound for a long time. After eight days it is still 65% present - benzyl alcohol has a shorter life. Many researchers were sceptical about the presence of benzyl acid in the preparation, since they were afraid of possible adverse reactions. Our experience has never found any haematological alteration or undesired clinical reaction, and we always followed the dosages suggested by the producer.

In my ward, the surgical emergency unit of the Gaslini Institute, I have been using Hyalomatrix on second- and third-degree burns for more than three years. This medication is composed of a non-woven fabric of Hyaff, supported by a thin transparent silicone membrane. The silicone membrane prevents liquid loss and allows monitoring of the wound.

When Hyaff comes into contact with exudate, it jellifies and creates an environment favourable to wound healing and to the orderly deposition of collagenous fibres.

Application is non-traumatic. Hyalomatrix is placed directly on the wounds and, if necessary, fixed with metal clips. Its removal after three or four days is completely painless.

We usually use Hyalomatrix in deep second-degree burns from the second medication until healing. The healing time appears to be shortened. We have seldom observed infections, the aesthetic results are better, and the scars are softer.

## **Results**

P.R. was a 10-month-old patient with burns due to boiling liquid in 20% of the total body surface area (TBSA) in the thorax, neck, and right arm. He was treated with lyophilized porcine skin for second-degree burns in the thorax and with Hyalomatrix

on deep second- and third-degree wounds in the arm. He healed completely and was dismissed after two weeks.

In young children it is not always convenient to use extensive escharectomies. The use of Hyalomatrix allows soft but effective escharectomy in a relatively short time.

We use Hyalomatrix in third-degree burns both in non-infectious wounds in the early post-burn phases and after surgical escharectomy as a temporary covering for wounds before traditional grafting or the application of in vitro cultivated autologous dermis or keratinocytes.

M.F. was a patient with serious third-degree fire burns in 60% TBSA in the face, neck, thorax, and upper and lower limbs. She was treated with Hyalomatrix, to favour escharectomy, and with grafting - both traditional grafting and grafting with autologous keratinocytes.

### **Advantages**

The advantages of the use of Hyalomatrix can be summarized as follows:

- Deep second-degree burns show a high percentage of healing.
- Hyalomatrix favours healing since it creates a wet microenvironment and an elastic tissue.
- It makes it possible to clearly distinguish areas that need to be treated surgically.
- It favours good escharectomy.
- It leads to an orderly arrangement of the collagenous fibres.
- Its removal and substitution are painless for the patient.
- It helps to prevent infection.
- It allows monitoring of the wound.

### **Disadvantages**

On the other side of the coin:

- It is expensive.
- It cannot be used on infectious wounds.
- On jellifying, it takes on a greenish colour which can be misinterpreted as a symptom of infection.

Many researchers were afraid of possible adverse reactions due to the presence of benzyl alcohol. We have continuously monitored hepatic and renal function and have never found this. As I have already said, we always stick to the doses suggested by the producer (one 10 x 20 sheet every 5 kg).

F.C. was a 13-month old patient with hot surface burns on the left hand. He was treated with Hyalomatrix and healed in 15 days.

M.C. was a 7-yr-old patient with fire burns in the thorax, left arm, and legs. She was treated with Hyalofill (Hyaff without silicone) and Hyaloskin and traditional grafting. She was discharged after 20 days' hospitalization with very good aesthetic results.

B.B. was a young patient of 10 years of age with fire burns in the upper limbs. She healed with the application of Hyalomatrix. The aesthetic and functional result was pretty good.

C.K. was a 5-yr-old patient with fire burns in 40% TBSA. When admitted, she had serious respiratory difficulties and was intubated for fifteen days. The wounds, nearly all third degree, involved the face, neck, thorax, upper limbs, and hands. She was treated with Hyalomatrix in order to prepare the receiving bed for traditional grafting and in order to favour healing in more superficial areas. The thorax healed spontaneously. The hands were treated first with Hyalomatrix and then with traditional grafting.

## Conclusions

Clinical results showed that Hyalomatrix is an effective and practical skin substitute. The absence of human or animal-derived components is a further guarantee of the product's biological safety. This treatment is a step on the way towards better healing of partial- and full-thickness burns. The study of the extracellular matrix and of its interaction with cells could lead to better aesthetic and functional results. Like every other human conquest, the healing of severely burned patients is the result of a long process, the milestones of which are represented by the continuous improvement of methods and products but also by the steady commitment of the "burn team".

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### Address correspondence to:

Dr. A.M. Tamisani, Giannina Gaslini Institute 5, 16147 Quarto, Genoa, Italy

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