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DECLARATION OF ACCURACY AND PRECISION

Re: Translation from Portuguese into English

Article "Cellulose membrane - A temporary skin substitute"

by O.C. Castro, etc.

This declaration certifies the accuracy and precision of the translation from Portuguese into English of the above material and is an accurate reflection of the text as it appeared in Portuguese.

for the translator:

Translator

10/4/1994

Date

HFA-Publ. Téc. Cient., Brasilia 3(3): 209-232, 1988

CELLULOSE MEMBRANE
A TEMPORARY SKIN SUBSTITUTE*

by

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and V. M. Nogueira****

The aerobacter bacteria is capable of producing a cellulose fold with great resemblance to the human skin. Its average thickness is 0.5 mm and by electronic microscopic studies it was found a microfibrilar structure. This fold adheres to the surface, protecting it against contamination and sterilized in ethilene oxide. Our experience with this temporary skin substitute comprises 40 cases with good results. The skin color becomes different, but much less with others methods. In two cases there were skin hypertrophy with granulation. In three cases the treatment failed on eccount of infection. The presence of yellow secretion requires close observation of the granulation surface and utilyzation of a new cellulose fold. We did not see a single case of allergic symptoms.

Key Words: Skin subetitute, cellulose, cutaneous loss.

INTRODUCTION

Because of the extensive area represented by the body's skin, the latter is subjected to a variety of traumas. In certain cases of skin loss in which immediate replacement is impossible, or in other cases, while epithelialization is occurring, the use of a substitute for temporary covering becomes important.

Up until the present time, the ideal substitute for skin had not been discovered. It should exhibit properties relating to adhesion, elasticity, and permeability to water vapor, serve as a

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bacterial barrier,[1,3] and be nontoxic, nonantigenic, antiseptic, easy to apply and remove, inexpensive, and endowed with durability.[3]

This being the case, researchers continue to search for the skin substitute that best approximates ideal models.

Among temporary skin substitutes already in existence are the organic ones (homologous graft, pig skin,[3] bovine embryo skin, and collagen), the synthetic ones (silicone, Hydrone, and polyurethane), and combinations of both kinds.

HISTORY OF THE CELLULOSE MEMBRANE

The Curitiban researcher Luiz Fernando Xavier Farah, in 1984, in conducting studies in apiculture, observed that bacteria of the Acetobacter genus produced a cellulose membrane that showed a great similarity to human skin.[4]

After studies and investigations, the first clinical observations with the cellulose membrane were made together with the Burns and Plastic Surgery Service of the Cajurú Hospital, by the Catholic Pontifical University of Paraná.[5] The clinical cases embraced skin-donor areas, second degree burns, dermal abrasions, and chronic ulcers.

MATERIAL AND METHODS

During the conduct of this work in the Fortaleza-INAMPS General Hospital, from May 1986 on, the cellulose membrane was utilized as temporary skin substitute.

The cellulose membrane is of biological origin, produced by bacteria of the Acetobacter genus.[6] Its mean thickness is 0.050 mm, and electron microscopy revealed its structure to be microfibrillar, which makes the membrane permeable to water vapor and impermeable to liquids and microorganisms.[7] It sticks to the bloody surface, rendering it protected against external contami-

nation, decreasing water and electrolyte losses, and, in the great majority of cases, leaving it painless, even to touch.

Because it is transparent, the membrane makes it possible to observe the progression of each case without it being necessary to remove it; as it consists of an inert substance, it is nontoxic and does not provoke rejection. It exhibits resistance to traction and to elongation[7] and it has an appearance similar to that of human skin.

The cellulose membranes are sterilized in ethylene oxide; they do not require any special care in storage or transport[6] and they are supplied in standard sizes (cm): 21 x 16, 16 x 10, 10 x 8, and 6 x 6 (Fig. 1).

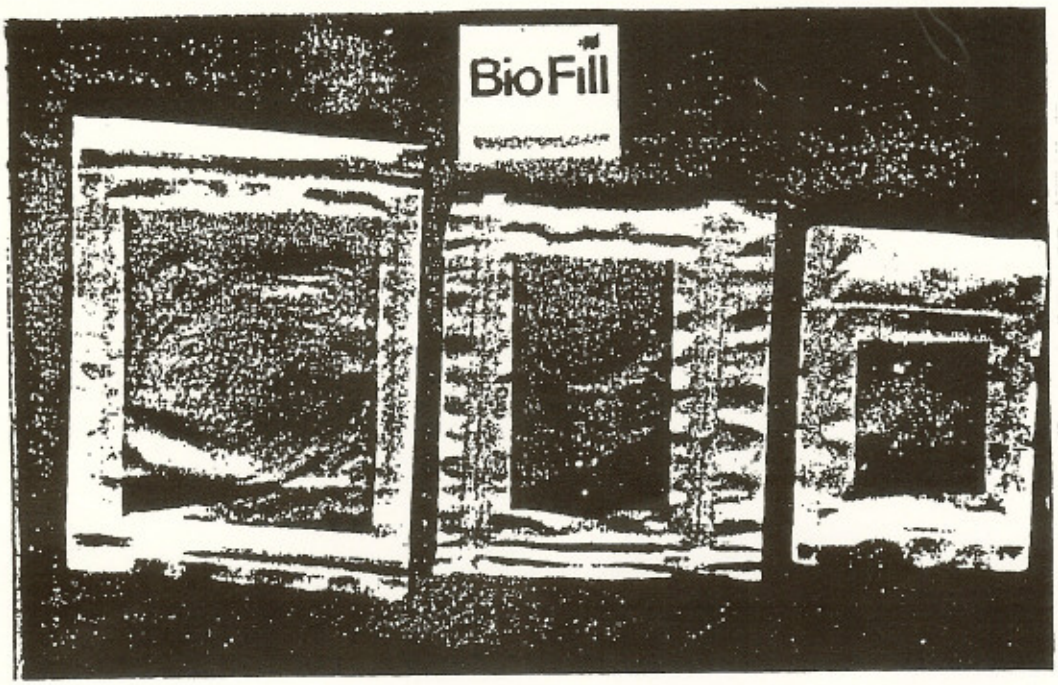

Fig. 1 - Cellulose membrane in its original packaging.

The technique for using the cellulose membrane, even though simple, does require aseptic measures, such as the use of gloves, rigorous cleansing of the area receiving the membrane, etc. In the majority of our cases, prior hydration of the membrane with physiological salt solution was done as much as three months before (Fig. 2), but in our last cases, this technical expedient was no longer utilized.

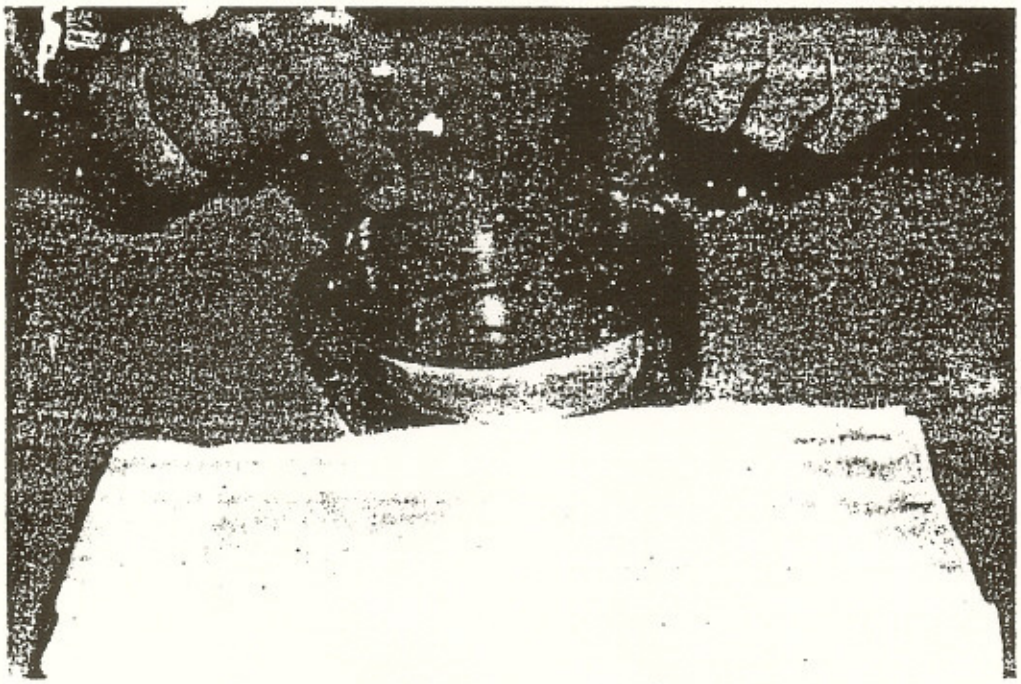

Figure 2 - Hydration of the cellulose membrane with physiological salt solution.

Subsequently, placement of the membrane over the bloody area was effected, care being taken to eliminate air bubbles or secretions, perfect coaptation to the bed being achieved. In the last 10 cases, the membrane was used without prior hydration, which seemed to be technically easier. In all the cases, the membrane must exceed by 1 cm the limits of the bloody area (Figs. 3 and 4). In the cases of anesthetized or poorly cooperating patients, on joint surfaces, and in young children, it is preferable to use an occlusive dressing for 48 hours.

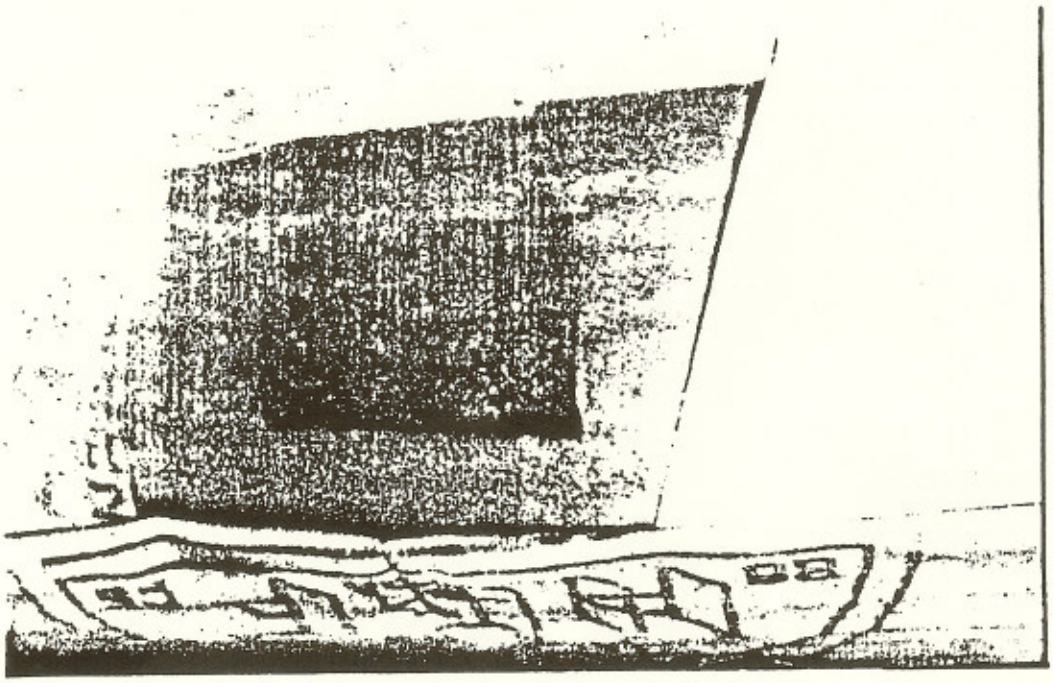

Figure 3 - Skin graft-donor area.

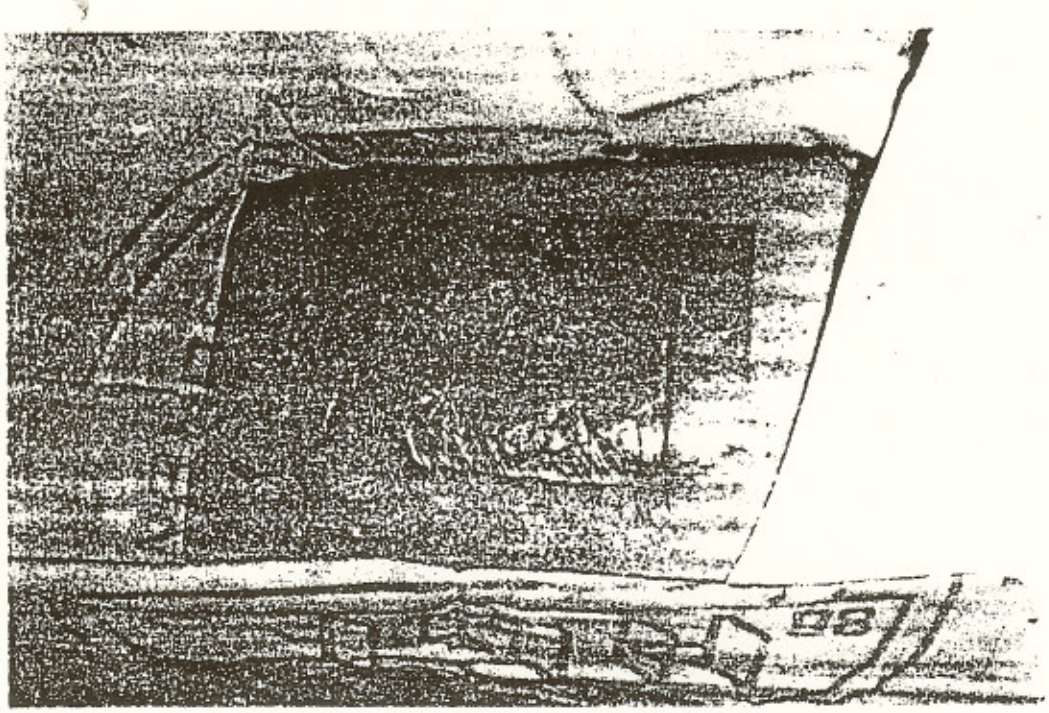

Figure 4 - Skin graft donor area covered with the cellulose membrane.

In the initial phase, an exudate appears under the membrane which coagulates after 24 hr, taking on a brownish color in the majority of cases. Afterwards the membrane sticks to the bed, protecting it (Fig. 5). The patient feels more comfortable, being able to perform some activities and hygienic measures with more freedom. In case it should be necessary, removal of the membrane is painless, it is sufficient to hydrate it beforehand, with physiological salt solution.

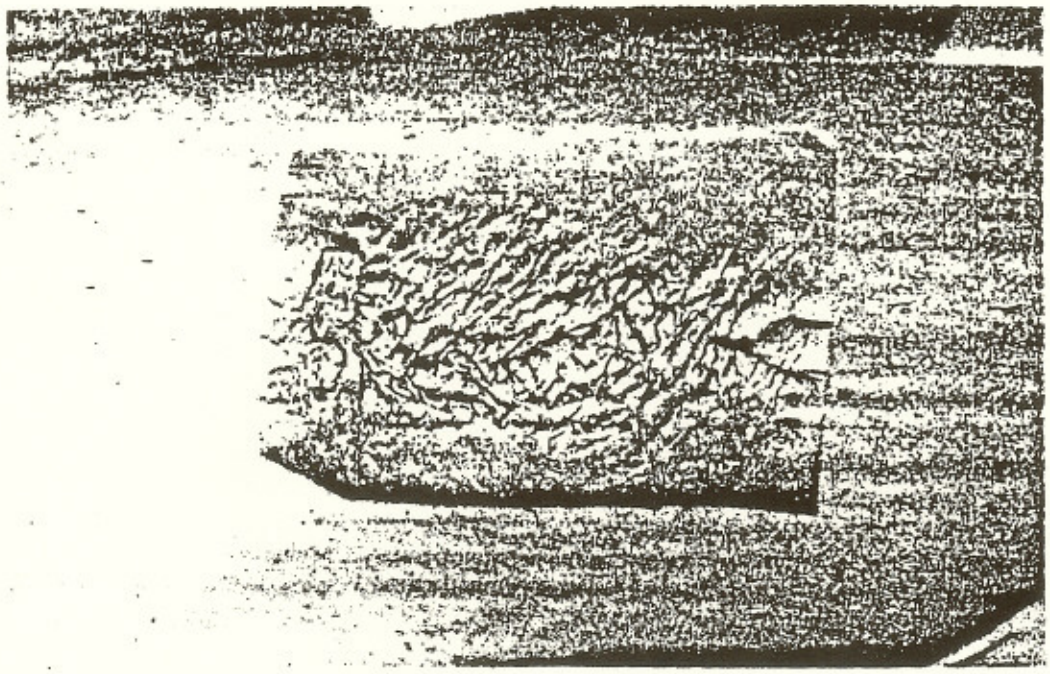

Figure 5 - Donor area two days after application of the membrane.

DISCUSSION

We observed the progression of 40 cases that presented losses of cutaneous substance of varied etiology (Table I) in which cellulose membranes were utilized as temporary skin substitutes.

TABLE I

INDICATIONS	No. CASES	%
Painful skin-graft donor areas	27	67.5
Areas receiving mesh grafts	03	7.5
Losses of substance through trauma	03	7.5
Post-infection losses of substance	03	7.5
Third degree burn (chronic)	01	2.5
Post-debridement defect	01	2.5
Post-tumor resection bloody area	01	2.5
Patch-donor area	01	2.5
TOTAL	40	100.0

In 28 cases (70%), 25 being skin graft donor areas and three, mesh-graft receiving areas, progression was normal (Table 2). After being applied and dehydrated, the membrane adhered to the receiving bed, undergoing fragmentation on the 7th day (Fig. 6), with a variation of around 2 days. In this phase, rosy, smooth, and shiny tissue can be seen between the scabs. Complete cicatrization, with elimination of the scabs, occurred, on the average, on the 13th day (Fig. 7), with a variation of approximately 3 days. The skin appeared smooth in 100% of the cases of donor areas. Apparently, the dyschromia that occurs in these skin graft donor areas is less than in the cases treated with conventional dressings. The hemostatic activity of the membrane can also be verified. In the cases of expanded mesh grafting of skin, the cellulose membrane adhered to the multiple and small bloody areas. It was possible to follow the whole progression (Figs. 8, 9, 10, 11, 12, and 13), thanks to the semitransparency of the membrane, without the necessity of removing it, as happens with other dressings.

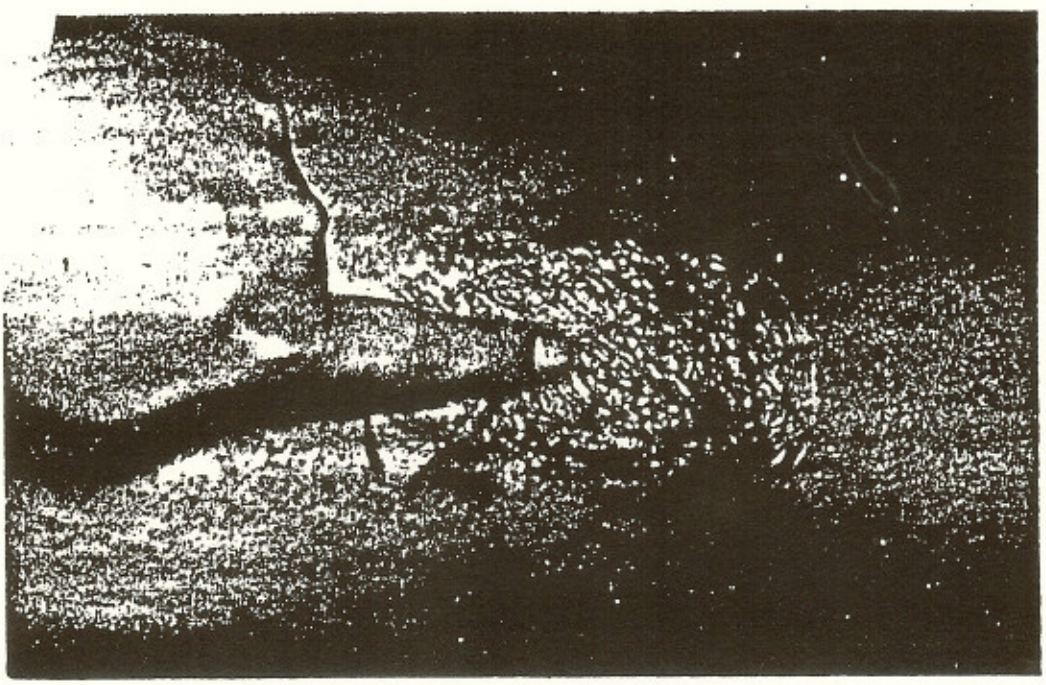

Figure 6 - Donor area painless to touch and membrane in phase of fragmentation at seven days.

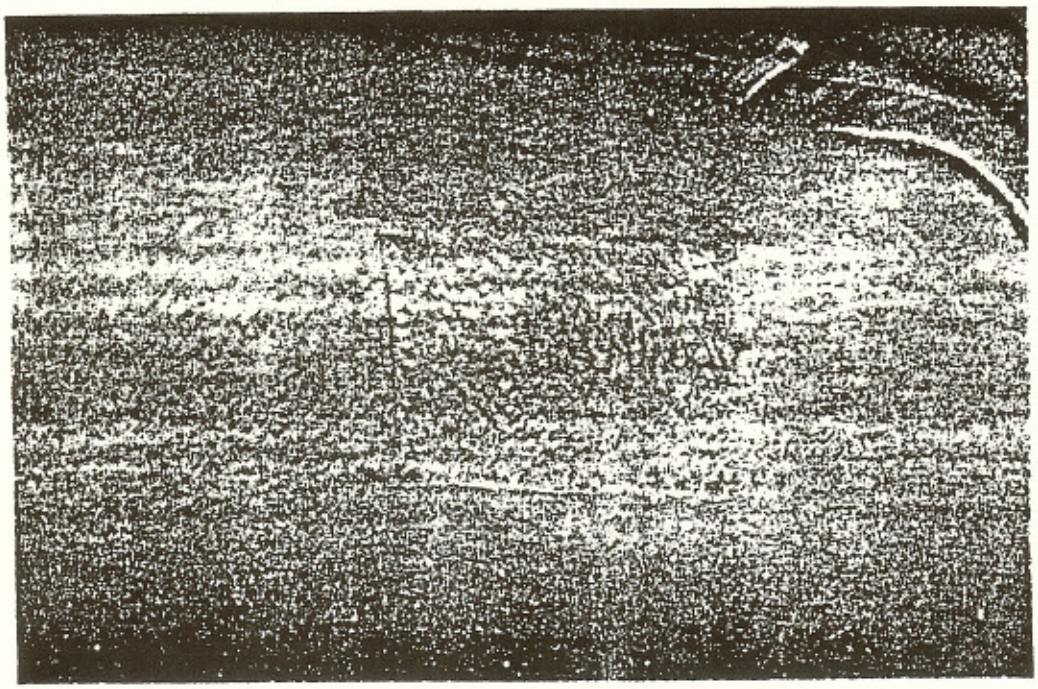

Figure 7 - Donor area completely epithelialized in 13 days.

TABLE II

PROGRESSION	No. CASES	%
Normal	28	70.0
Interrupted for grafting	09	22.5
Interrupted by infection	03	7.5
TOTAL	40	100.0

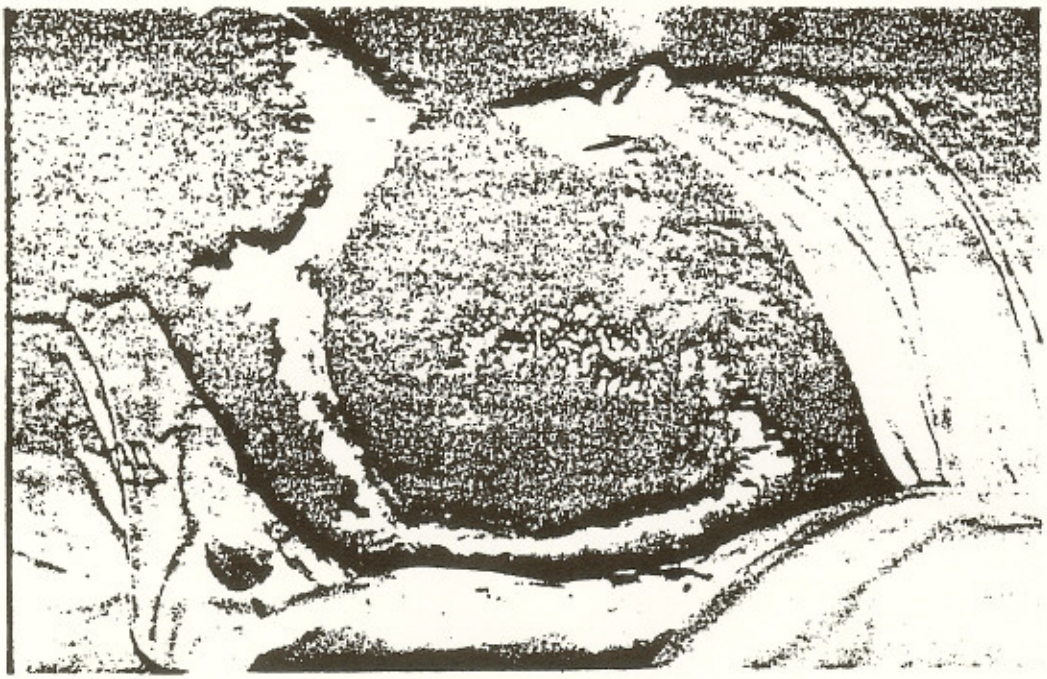

Figure 8 - Third degree burn with retraction of thigh. 10 months' progression; subject originating from another state.

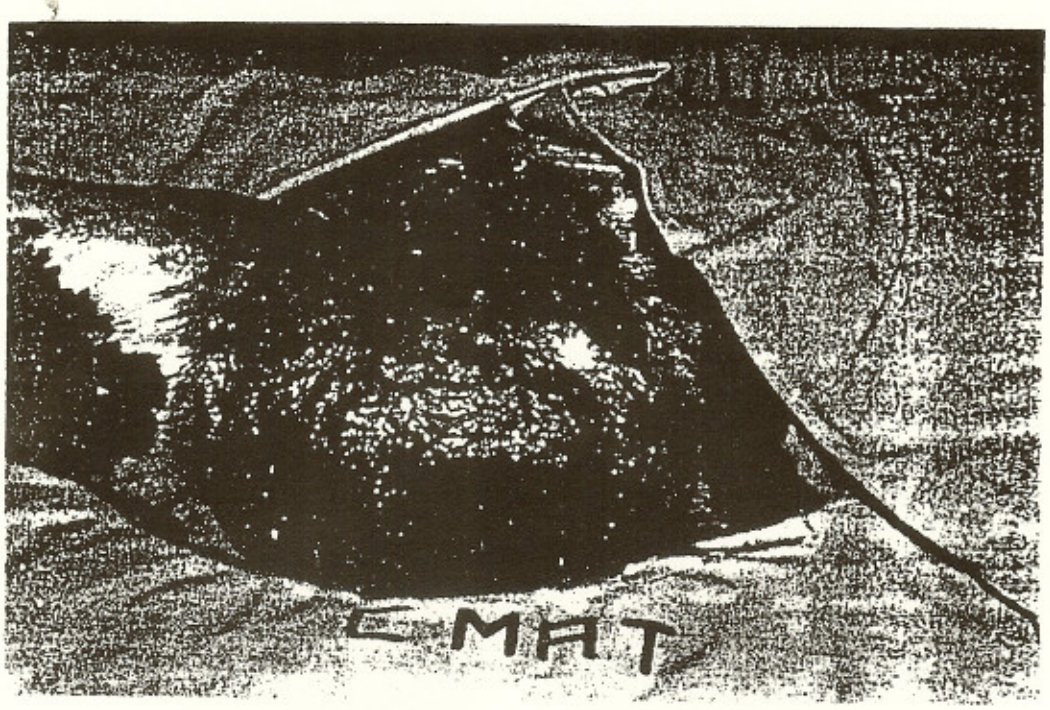

Figure 9 - Third degree burn after freeing of cicatricial retraction.

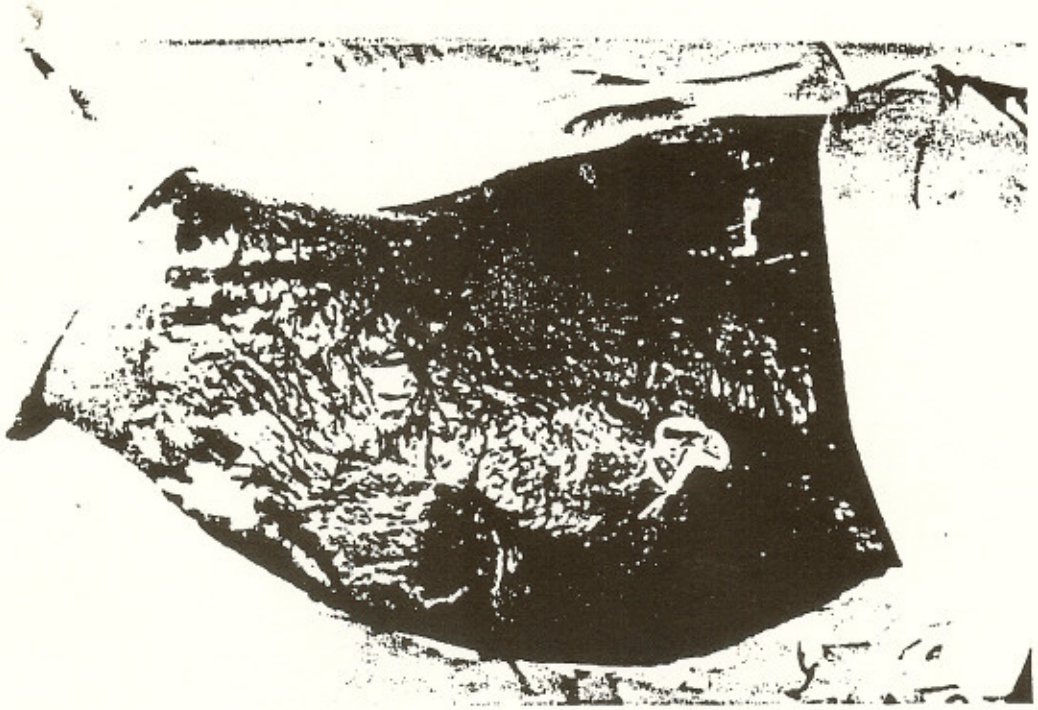

Figure 10 - The membranes are adherent to the small bloody areas of the mesh skin graft receiving area

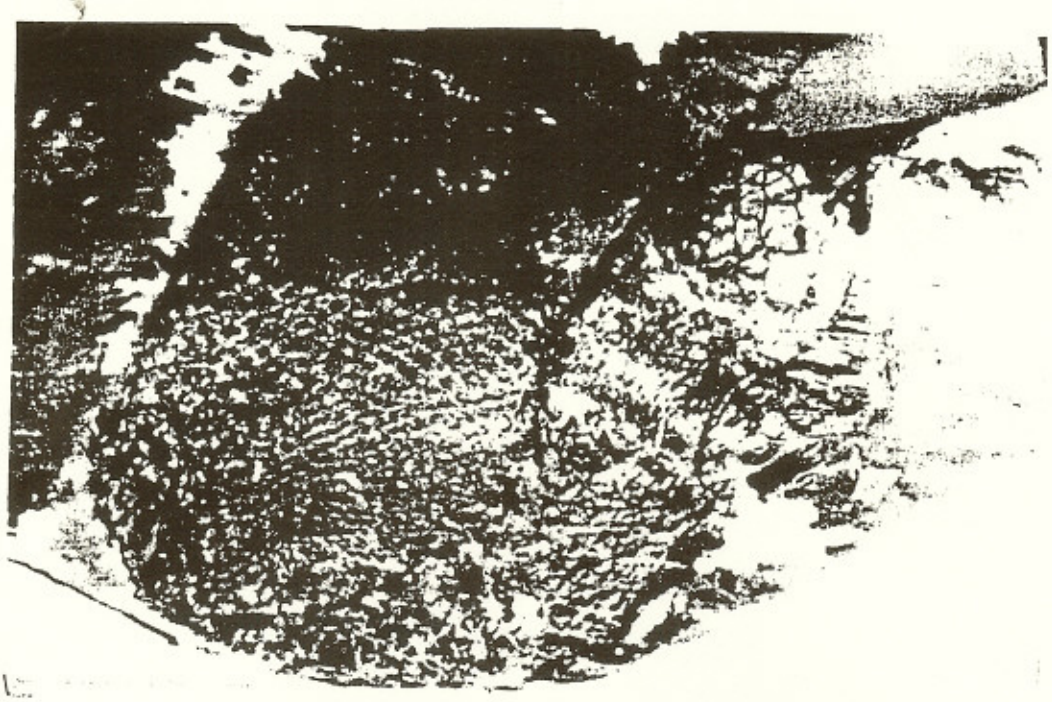

Figure 11 - Phase of fragmentation of the membranes.

Figure 12 - Area receiving mesh graft already cicatrized.

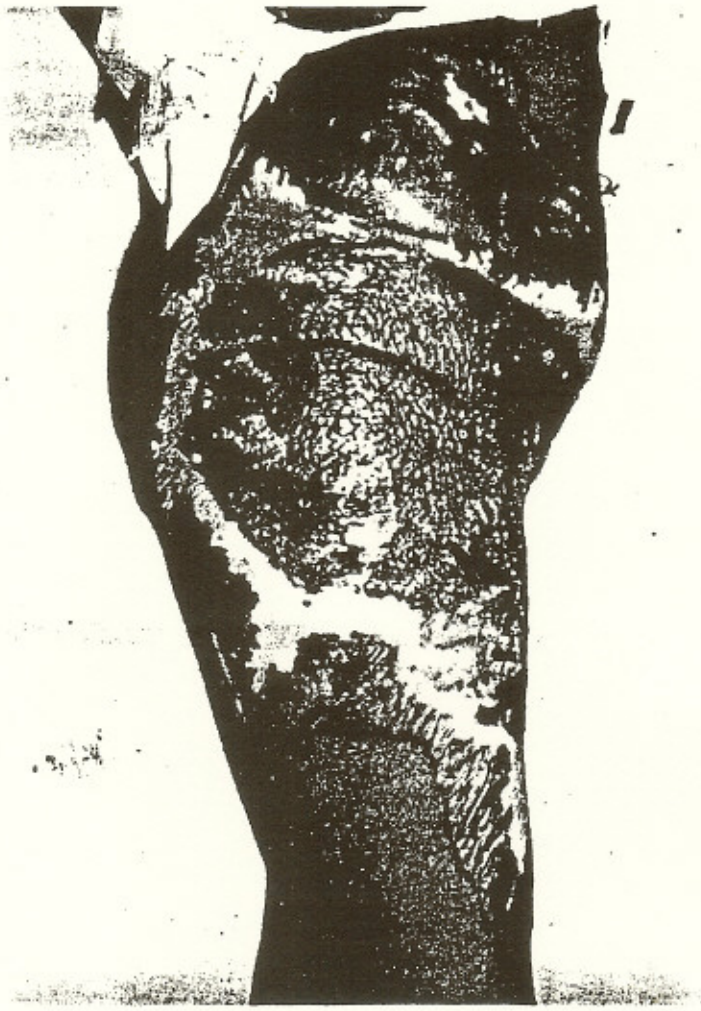

Figure 13 - Area receiving mesh graft already cicatrized.

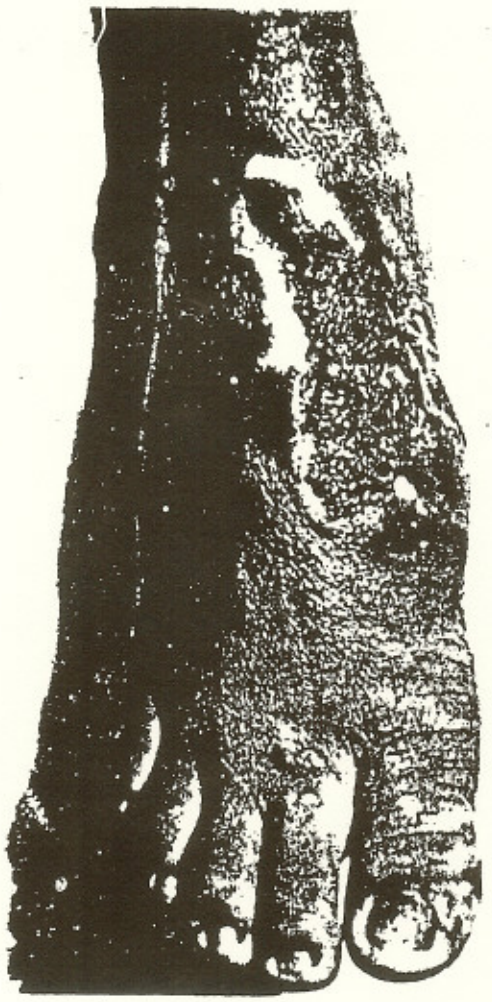

Figure 14 - Traumatic skin loss.

Of the 12 cases corresponding to the other indications for the use of cellulose membranes, the latter were maintained in 9 cases (22.5%) for a period that ranged from 4 to 11 days (Figs. 14 to 19), until performance of definitive skin graft (Table II). Granulation tissue developed, forming a delicate and uniform layer. In only 2 cases was there hypertrophy of the granulation, the excess of which was resected before grafting without any problem.

The use of the cellulose membrane was interrupted by the presence of infection (Table II) with abundant purulent secretion in 3 cases (7.5%).

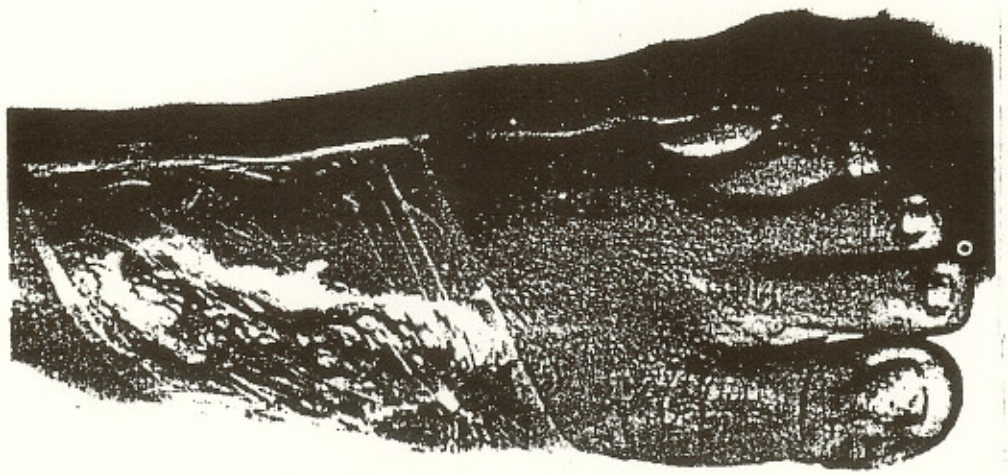

Figure 15 - Traumatic skin loss covered (provisionally) with the cellulose membrane.

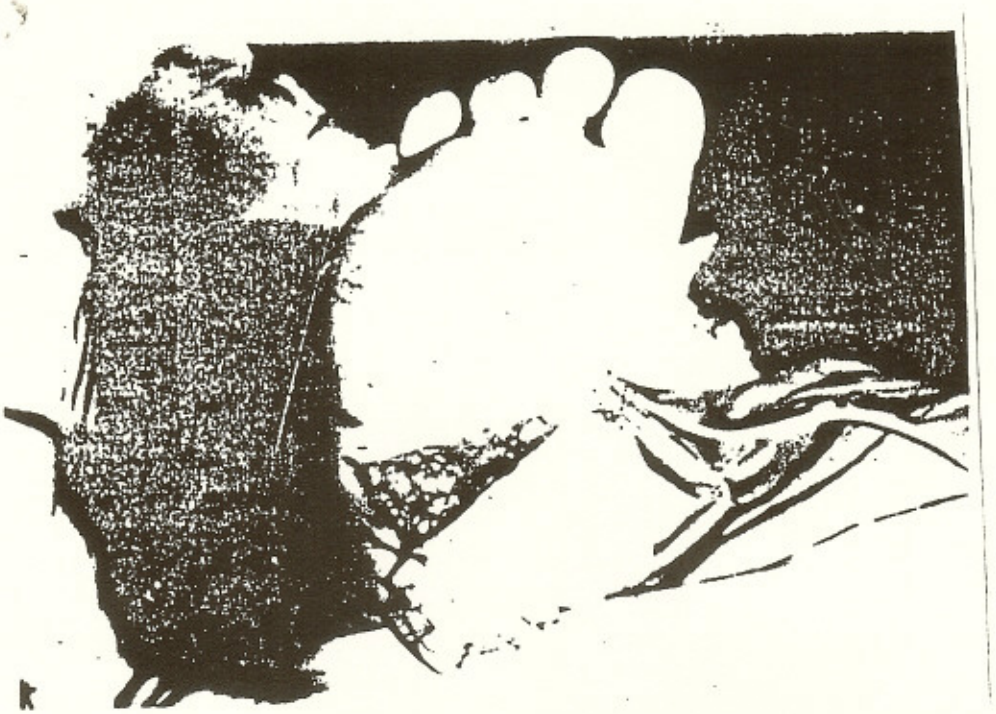

Figure 16 - Donor patch area for calcaneal ulcer.

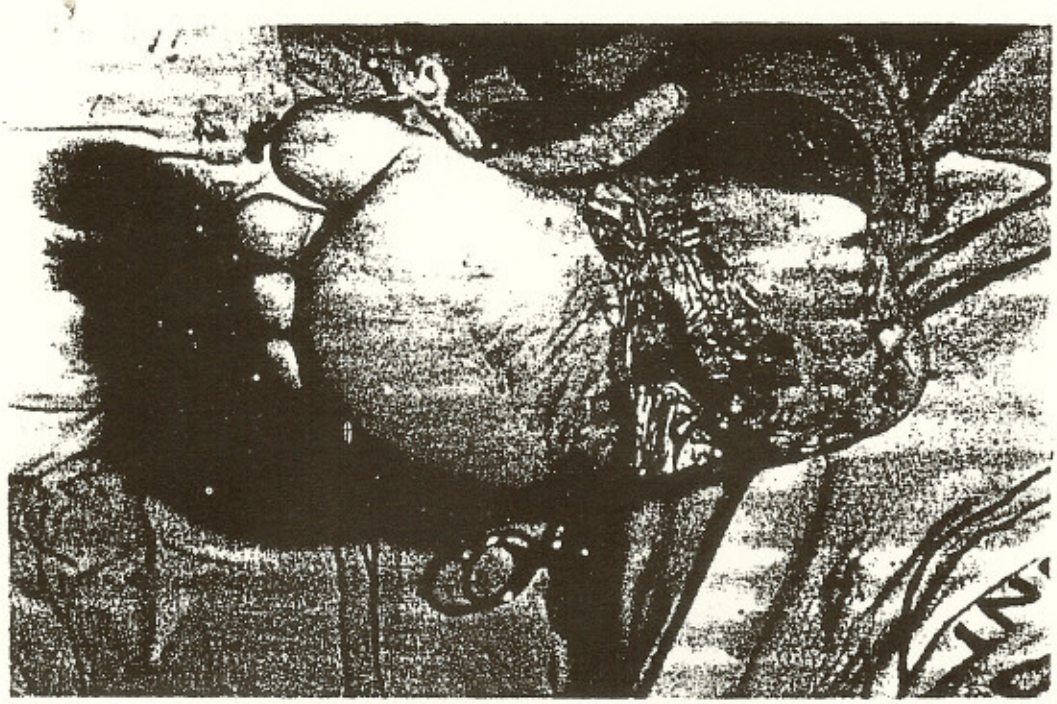

Figure 17 - Same area, covered (provisionally) with the cellulose membrane, because the patient had presented transoperative complications preventing grafting.

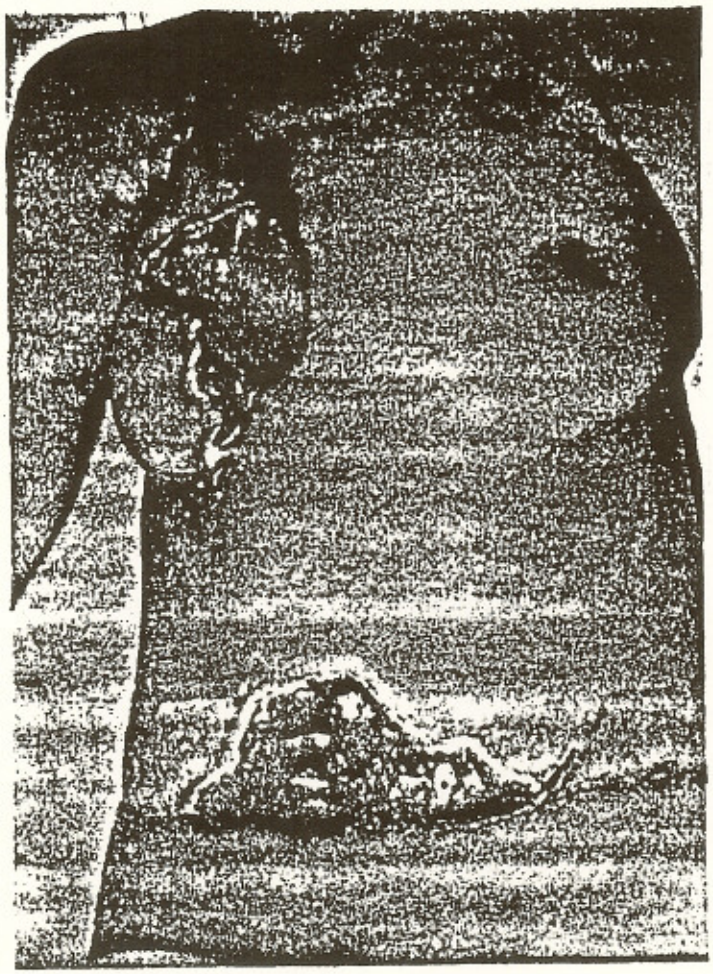

Figure 18 - Skin loss on the thorax and abdomen after direct breast reconstruction with musculus rectus abdominis patch, complicated by infection, necrosis, and dehiscence.

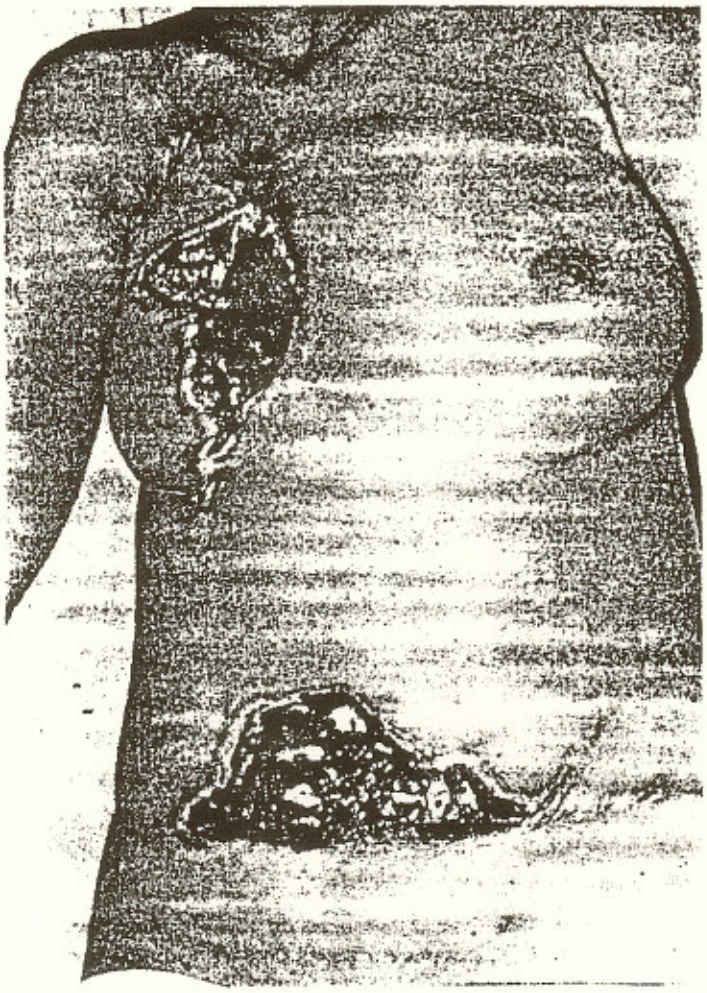

Figure 19 - Bloody areas covered (provisionally) with the cellulose membrane, after debridement.

SYMPTOMS AND SIGNS

The presence of some symptoms and signs related to the use of the cellulose membrane may be verified (Table III).

TABLE III

SYMPTOMS AND SIGNS	No. CASES	
Yellowish secretion	13	
Pain/burning sensation	07	
Purulent secretion	03	
Pruritus		03
Hematoma	03	
Hypertrophy	02	

In the first moments after the use of the membrane, there are cases of complaints of pain or burning sensation, which subside spontaneously. In 2 cases, the pain was more persistent, receding with the use of analgesic agents.

In another 5 cases, the pain was connected with the presence of secretion, disappearing after draining.

The presence of yellowish secretion was observed in 13 cases after the first 24 hr, without fetid odor and without signs of infection. In the cases of small volume, the secretion coagulated, becoming transformed into scabs, and the progression was normal. In the cases of more abundant secretion, with detachment of the membrane and fluctuation, it was resected in the detached area. After cleansing of the bloody area, a new membrane was put on, going 1 cm beyond the margins. This procedure was repeated as needed in each case.

There was hematoma formation in 2 cases; after draining, we proceeded in the way already mentioned, with normal progression being obtained.

Close to the period of scab elimination, there were complaints of pruritus in 2 cases. In another one, pruritus occurred throughout the whole treatment (13 days). In none of the cases was any local serologic reaction observed.

CONCLUSION

Studies have already confirmed that bacteria of the genus Acetobacter produce a cellulose membrane that shows a similarity to human skin.

This cellulose membrane may be utilized as a temporary skin substitute.

Standing out among its useful qualities are its selective permeability, adherence to the receptor bed, lack of toxicity, and the fact that it does not provoke rejection.

It requires for its application, an aseptic technique without any great refinements.

The whole progression of the cases can be followed, thanks to the semitransparency of the membrane.

The cellulose membrane is a major contribution to cases of loss of cutaneous integrity in which there is a need for a temporary substitute and the best results was in the cases of skin graft donor areas and the cases of receptor areas for grafts expanded with mesh.

Joint efforts are anticipated, in the direction of increasing qualitative and quantitative experience with the use of cellulose membrane, which will enrich the therapeutic arsenal.

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