Chapter

Scars: A New Point of View in Plastic Surgery

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Abstract

The issue of achieving esthetically pleasing surgical scars has gained prominence in recent years, with the emergence of the concept of the "imperceptible scar," which is expected by patients of not only cosmetic but also reconstructive surgery. Current research in reconstructive surgery focuses on obtaining high-quality results in the minimum number of steps, with a view to "doing it right the first time." However, there is no uniform approach to scar treatment, which is partly due to a lack of consensus regarding the most effective healing methods. This chapter aims at shedding new light to discussion by putting forward two different procedures that enhance scar results in cosmetic and reconstructive surgeries by applying a topical treatment with active ingredients and by combining cadaver and artificial skin as dermal substitutes, respectively. The effectiveness of these treatments is shown by means of objective, quantifiable data collected as a result of studies and postoperative follow-ups carried out at Hospital Alemán in Buenos Aires.

Keywords: scars, surgical wound, wound healing, reconstructive surgery, esthetic surgery

1. Introduction

Scars are a natural part of dermal healing following lacerations, incisions, or tissue loss. Wound healing, which is a natural process of tissue repair, consists of three phases: inflammation, fibroplasia, and maturation. The healing tissue generates changes in the cutaneous architecture, which renders the skin surrounding the scar different from the rest of the skin in terms of color, thickness, elasticity, texture, and degree of contraction [1]. In surgical procedures, scars, which are the only visible sequela of the intervention, result from the reparation process undergone by the skin to heal the wounds caused by surgery or trauma. Because of its impact in scarring, considerable importance is placed on the closure of a surgical incision, which is the final phase of the intervention [2]. The ideal scar is narrow, flat, level with surrounding tissue, and difficult for the untrained eye to see due to color match and placement parallel to relaxed skin tension lines. In contrast, hypertrophic, keloidal, dyspigmented, widened, contracted, or atrophic scars can be unsightly and/or cause functional limitations, which patients often perceive as a problem.

Thus, when the scar has unfavorable characteristics, scar revision is often indicated. Furthermore, as poor-quality healing of an incision can constitute a disabling pathology [3], scar treatment should not be considered as a trivial part of the intervention. On the contrary, wound treatment and care after surgery of any kind, including esthetic or reconstructive interventions, should be initiated early.

In order to arrive at an effective esthetic and functional outcome, surgeons must be familiar with the different scar treatments available, and they must also know how to prevent scars and how to reduce them after surgery. In this sense, it should be borne in mind that, while there exist multiple treatment modalities, none of them guarantees a 100% success rate. Current guidelines suggest a multimodal approach to treating scars but there is no gold standard for their treatment. In this chapter, we will present two new ways to treat scars following plastic surgery. As explained in the following sections, these techniques were successfully implemented in a number of cases, and their comparative advantages regarding other methods were also evaluated. We hope that our contribution will help point in the direction toward an effective, uniform standard.

The first part of our research deals with cosmetic surgery scars, which generally receive different topical treatments that help maintain the moisture and the plasticity of the wound. Besides, these treatments prevent wound contamination or infection, which would delay healing. We have analyzed and compared the results of two of these treatment options and found that the best functional and esthetic results are obtained when using a cream with active ingredients. The second part of our research revolves around the combined use of two skin substitutes, cadaver skin and artificial skin, so as to obtain improved results in reconstructive surgery after trauma injuries with abnormal wound healing in response to skin trauma or inflammation. Employing dermal substitutes result in a better regeneration of the dermis and in dermal fibroblast optimization. In the next sections, we will present a detailed account of the two studies we have carried out, which will allow us to further discuss the aforementioned techniques to optimize surgical scars.

2. Topical treatment of cosmetic surgery scars

As we have already mentioned, the first study involved the comparison and evaluation of two topical treatments applied to scars resulting from cosmetic surgery. One was a cream containing 1 g of silver sulfadiazine, 248,000 IU of vitamin A and 0.666 g of lidocaine in each 100 g of product (Platsul-A®, Soubeiran Chobet Laboratory, Autonomous City of Buenos Aires, Argentina) (cream A), and the other was a moisturizing cream based on petrolatum, keto-stearyl alcohol, glycerin, and water without any active ingredient (cream B). About 32 patients participated in the study; 24 with bilateral breast implants and 8 with face and neck lifts, hence totaling 64 scars. The study included patients of both sexes: 31 women and 1 man, with ages ranging from 22 to 64 years (mean of 41 years). All patients received both topical treatments under study, each of their postsurgical scars (right and left) being applied one of the creams at random. We monitored patients for 1 month after the beginning of treatment, meeting them at an initial appointment and at subsequent appointments after 3, 6, 9, 16, 23, and 30 days from the intervention. Each patient's progress was checked by the same medical examiner.

In these appointments, we measured the length and width of the scars to determine their total surface and assessed them in accordance with the Vancouver scar scale (VSS) and the patient and observer objective assessment scale (POSAS). We evaluated (1) the surface area of each scar by multiplying its length by its width, as measured with a ruler with graduation, (2) the quality of each scar as assessed by the VSS, [4] taking into account the parameters of pigmentation, vascularity, and thickness, and (3) the patient's perception of each scar as appraised by the POSAS, [5] by having them rank a series of symptomatic and esthetic parameters. The results are reported as follows, discriminated on the basis of the type of surgery performed.

2.1 Surface area of each scar

In the group of patients with breast implants, the percentage of change did not differ significantly between the two treatments studied in the appointments of days 3, 6, 9, 16, and 23. On day 30, however, we detected a statistically significant difference (P = 0.017). The percentage of decrease was significantly higher in the scars treated with the cream with silver sulfadiazine, vitamin A, and lidocaine (cream A) than in those treated with the cream without active ingredients (cream B) (18.6 and 9.5%, respectively) (**Table 1**). In the group of patients with face and neck lift, there was no significant difference between the percentage of change achieved due to the two treatments on days 3, 6, 9, and 16. Nevertheless, on days 23 and 30, we encountered a statistically significant difference (P = 0.026 and P = 0.007, respectively). The percentage of decrease was significantly higher in the scars treated with cream A than in those that had been treated with cream B. On day 23, the surface area of the scars treated with cream A had decreased, on average, by 14.8%, while that of the scars treated with cream B had increased, on average, by 24.9%. On day 30, the surface area of the scars treated with cream A had decreased, on average, by 19.1%, whereas that of the scars treated with cream B had increased, on average, by 22.2% (**Table 2**). **Figure 1** shows the changes in the surface area of each patient's scars on days 23 and 30 with respect to the initial appointment and classifies the results according to the type of surgery undergone and the treatment received. As we can see, more favorable results were obtained with cream A than with cream B, except in the case of two patients with breast implants (patients No. 7 and 12).

2.2 Vancouver scar scale

The VSS assigns values to the scar pigmentation, vascularity, and thickness, which are then added to obtain a total. Although the score may vary between 0 and 10, the average of the initial scores in our study was 2.7 and the maximum value observed throughout the study was 5. We conducted the analysis taking into account the absolute change in the VSS score with respect to the initiation of treatment (day 0). Results are expressed in absolute values. The analysis is carried out separately for each group of patients, depending on the type of surgery, on days 3, 6, 9, 16, 23, and 30.

In the breast implant patient group, the VSS score change did not differ significantly between treatments on days 3, 6, 9, and 16. On days 23 and 30, nonetheless,

Days	Average percentage of change of the surface area as from treatment onset (breast implant)		P
	Cream A (%)	Cream B (%)	
3	4.2	0.0	0.97 (NS)
9	2.6	3.7	0.37 (NS)
16	−1.8	−6.0	0.40 (NS)
23	−12.8	−7.2	0.089 (NS)
30	−18.6	−9.5	0.017*

*NS: not significant. *Significant: at 5%.*

Table 1.
Average percentage of change of the surface area of the scars treated with silver sulfadiazine, vitamin A, and lidocaine (cream A) and with a cream without active ingredients (cream B) in patients with breast implants after 3, 6, 9, 16, 23, and 30 days from the onset of the topical treatment.

Days	Average percentage of change of the surface area as from treatment onset (face and neck lift)		P
	Cream A (%)	Cream B (%)	
3	12.5	12.5	+
6	12.5	12.5	+
9	12.3	12.4	0.60 (NS)
16	2.1	24.9	0.07 (NS)
23	−14.8	24.9	0.026*
30	−19.1	22.2	0.007**

NS: not significant.
**Significant at 5%.*
***Significant at 1%.*
+No surface area changes were perceived in any patient in either of the treatments.

Table 2.
Average percentage of change of the surface area of the scars treated with silver sulfadiazine, vitamin A, and lidocaine (cream A) and with a cream without active ingredients (cream B) in patients with face lift after 3, 6, 9, 16, 23, and 30 days from the onset of the topical treatment.

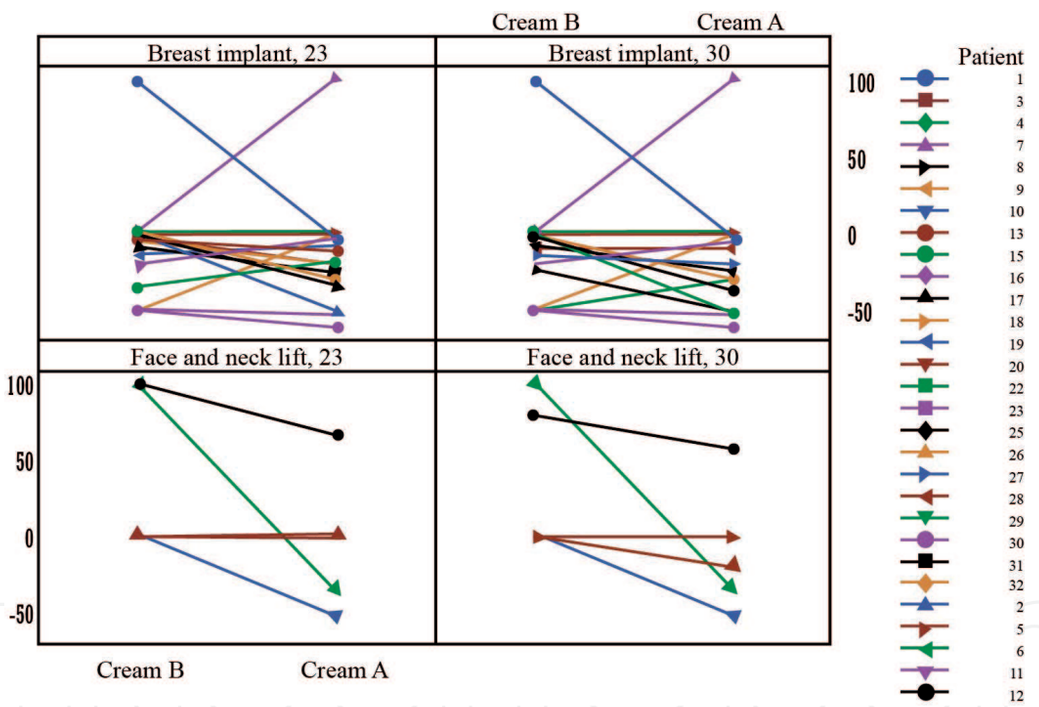

Figure 1.
Percentage changes of the scar surface area, per patient after 23 and 30 days from treatment onset.

we noticed a statistically significant difference (P = 0.02 and P = 0.006, respectively). The decrease was significantly higher in the scars treated with cream A in comparison with those treated with cream B. On day 23, the score of the scars treated with cream A decreased by 1.13 points average, while that of the scars treated with cream B increased by 0.04 points average. On day 30, the average score decrease was of 1.88 points in those treated with cream A and of 0.42 points in those treated with cream B (**Table 3**).

In the group of patients with face and neck lift, the change in the VSS score did not differ significantly between treatments after 3 days. Yet, in all of the following appointments, a statistically significant difference ($P < 0.05$) was observed. The reduction of the score was significantly higher in scars treated with cream A than in

Days	Average change in the VSS score as from treatment onset (breast implant)		P
	Cream A	Cream B	
3	0.33	0.21	0.80 (NS)
6	0.13	0.29	0.30 (NS)
9	−0.21	0.46	0.10 (NS)
16	−0.42	0.29	0.09 (NS)
23	−1.13	0.04	0.02*
30	−1.88	−0.42	0.006**

VSS: Vancouver scar scale.
NS: not significant.
**Significant at 5%.*
***Significant at 1%.*

Table 3.
Average change in the VSS score of scars treated with silver sulfadiazine, vitamin A, and lidocaine (cream A) and with a cream without active ingredients (cream B) in patients with breast implants after 3, 6, 9, 16, 23, and 30 days from the onset of the topical treatment.

Days	Average change in the VSS score as from treatment onset (face and neck lift)		P
	Cream A	Cream B	
3	0.50	1.50	0.17 (NS)
6	0.13	1.50	0. 048*
9	−0.13	2.00	0.029*
16	−0.50	1.88	0.029*
23	−0.86	1.75	0.020*
30	−1.88	1.88	0.007**

VSS: Vancouver scar scale.
NS: not significant.
**Significant at 5%.*
***Significant at 1%.*

Table 4.
Average change in the VSS score of scars treated with silver sulfadiazine, vitamin A, and lidocaine (cream A) and with a cream without active ingredients (cream B) in patients with face lift after 3, 6, 9, 16, 23, and 30 days from the onset of the topical treatment.

those treated with cream B. On day 23, scars treated with cream A had decreased by 0.86 points average, while those treated with cream B had increased by 1.75 points average. On day 30, the average score decrease of scars treated with cream A was 1.88 points, while the score of scars treated with cream B increased by 1.88 average points (**Table 4**). **Figure 2** displays the changes in the VSS scores for each patient with breast implants on 23 and 30 days, compared to the initial control. In a majority of patients, we see a favorable effect with the cream A treatment compared to cream B, except for three cases (patients No. 16, 28, and 30). **Figure 3** illustrates the changes in the VSS scores for each patient with face and neck lifts on days 6, 9, 16, 23, and 30 with respect to the initial appointment. In most cases, cream A shows a more favorable effect in comparison with cream B. Regardless of whether cream A or B had been used, in general, the changes observed in the VSS, either increase or decrease, were homogeneous in the three variables that make up this scale: pigmentation, vascularity, and thickness of the scar. **Figures 4–6** illustrate the different results obtained when applying each cream.

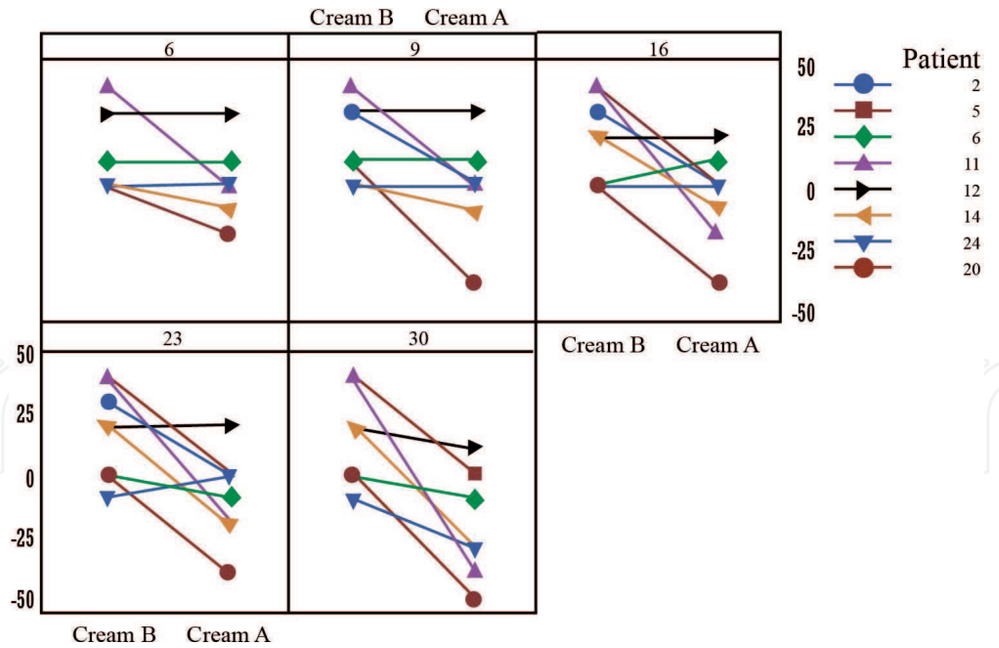

Figure 2.
Changes in VSS scores for each patient with breast implants after 23 and 30 days from treatment onset of treatment. VSS: Vancouver scar scale.

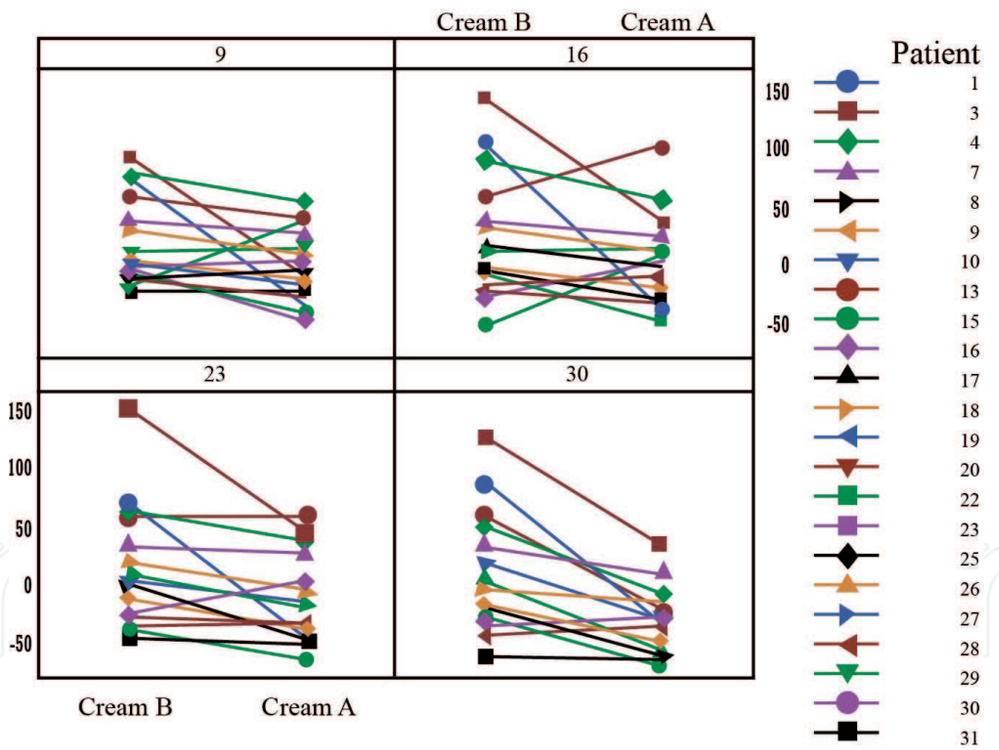

Figure 3.
Changes in VSS scores for each patient with cervical-facial stretch and after 6, 9, 16, 23, and 30 days from treatment onset. VSS: Vancouver scar scale.

2.3 Patient and observer objective assessment scale

This scale allowed us to evaluate numerically, based on the patient's own answers, scar characteristics related to pain, itching, color, stiffness, and thickness. The treating physician recorded the data reported for each variable and for each scar during the corresponding appointments. Although the score may vary between 0 and 60, the average of the initial scores was 16 and the maximum value observed throughout the study was 25. We carried out the analysis taking into account the

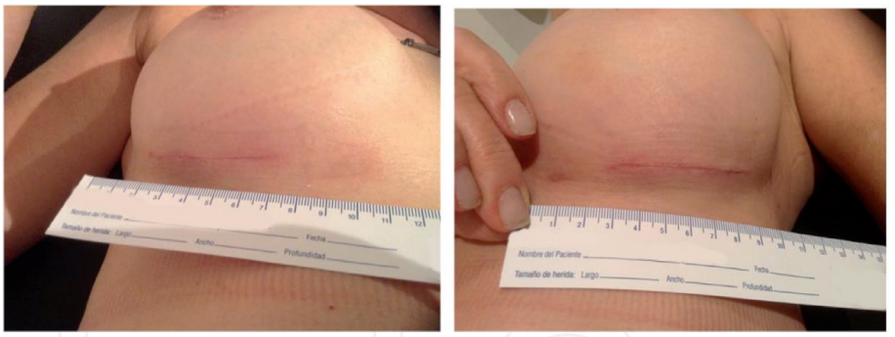

Figure 4.
Same patient's evolution with cream A (left) versus cream B (right) following a breast implant intervention (submammary incision).

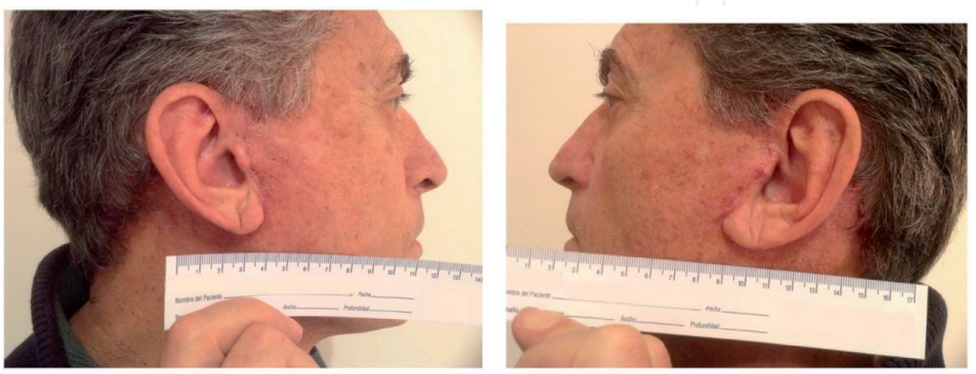

Figure 5.
Same patient's evolution with cream A (left) versus cream B (right) following a face lift intervention.

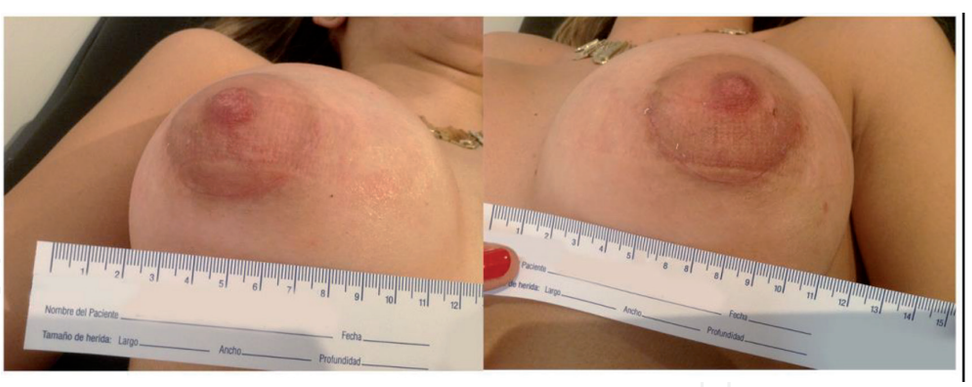

Figure 6.
Same patient's evolution with cream A (left) versus cream B (right) following a breast implant intervention (periareolar incision).

percentage change in the score of the scale with respect to that of the beginning of the treatment (day 0). We evaluated the results separately for each group of patients, depending on the type of surgery performed, and we considered the results obtained on days 3, 6, 9, 16, 23, and 30 of the postoperative period.

In the group of patients with breast implants, the percentage change of the score of the POSAS did not differ significantly between the treatments on days 3 and 6, but in the remaining appointments, we found a statistically significant difference ($P < 0.05$) in favor of cream A. The percentage decrease in the score was significantly higher in those scars treated with cream A than in those treated with cream B. On day 23, the score of scars treated with cream A decreased by

Days	Average change in the POSAS score as from treatment onset (face and neck lift)		P
	Cream A	Cream B	
3	2.5	8.5	1.0 (NS)
6	1.7	7.8	0.129 (NS)
9	−6.2	7.1	0.026*
16	−9.9	6.6	0.037*
23	−21.8	−1.3	0.005**
30	−37.7	−7.3	0.0007**

POSAS: patient and observer scar assessment scale.
NS: not significant.
**Significant at 5%.*
***Significant at 1%.*

Table 5.
Average POSAS score change rate for scars with silver sulfadiazine, vitamin A, and lidocaine (cream A) and with a cream without active ingredients (cream B) in patients with breast implants after 3, 6, 9, 16, 23, and 30 days from the onset of the topical treatment.

Days	Average change in the POSAS score as from treatment onset (breast implant)		P
	Cream A	Cream B	
3	22.1	18.2	0.66 (NS)
6	18.2	20.2	0.40 (NS)
9	19.0	26.3	0.26 (NS)
16	18.0	23.9	0.36 (NS)
23	−1.4	32.7	0.07 (NS)
30	−14.4	26.6	0.021*

POSAS: patient and observer scar assessment scale.
NS: not significant.
**Significant at 5%.*

Table 6.
Average POSAS score change rate for scars with silver sulfadiazine, vitamin A, and lidocaine (cream A) and with a cream without active ingredients (cream B) in patients with face lift after 3, 6, 9, 16, 23, and 30 days from the onset of the topical treatment.

21.8 points average, while that of the scars treated with cream B did so by 1.3 points average. On day 30, the average score decrease was of 37.7 points in scars treated with cream A while, in those treated with cream B, the decrease was 7.3 points average (**Table 5**).

In the group of patients with face and neck lifts, the percentage change in the POSAS score did not differ significantly between the treatments on days 3, 6, 9, 16, and 23. On day 30, however, we detected a statistically significant difference ($P = 0.021$) in favor of cream A. The percentage decrease was significantly higher in cases treated with cream A versus those treated with cream B. On day 30, the score of scars treated with cream A decreased, on average, by 14.4%, while that of the scars treated with cream B increased, on average, by 26.6% (**Table 6**). **Figure 7** presents the percentage changes of the POSAS scores for each patient with breast implants on days 9, 16, 23, and 30 with respect to the initial appointment,

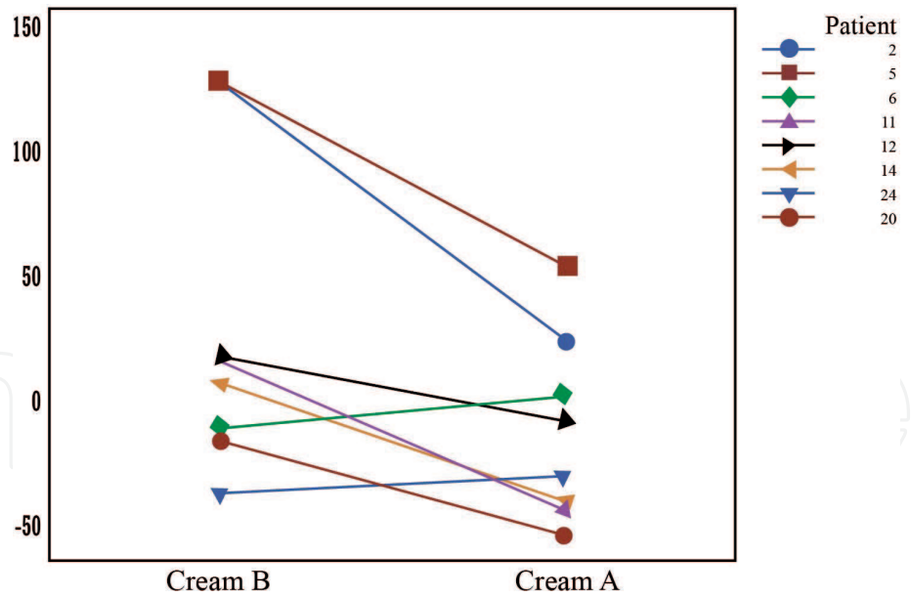

Figure 7.
Percentage POSAS score changes for each patient with breast implants after 9, 16, 23, and 30 days from the beginning of treatment. POSAS: patient and observer objective evaluation scale.

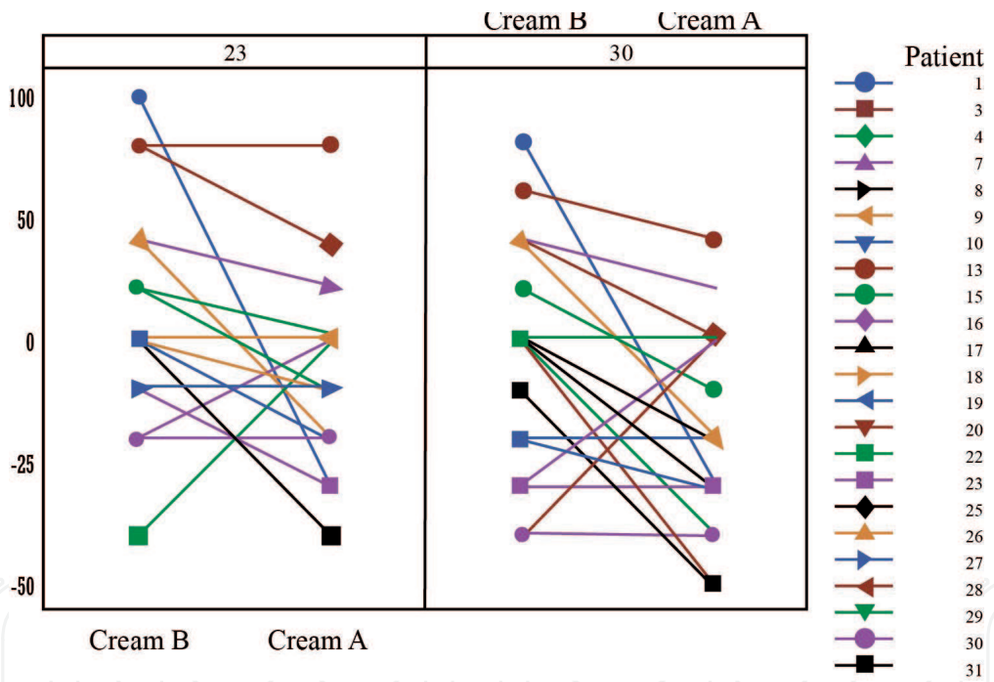

Figure 8.
POSAS score changes for each patient with face lift after 30 days from treatment onset. POSAS: patient and observer objective evaluation scale.

differentiated according to the treatment applied. In most patients, we see that the treatment with cream A resulted in a more favorable effect than that obtained with cream B, except for two cases (patient No. 15, days 9 and 16; and patient No. 13, day 16). **Figure 8** shows the percentage changes of the POSAS scores for each patient with face and neck lift between the onset of the treatment and day 30 and organizes the results based on the cream employed. In most cases, a better outcome was reached with cream A than with cream B. Irrespective of the cream applied, in general, the changes observed, either increase or decrease, reflected homogeneous changes in the variables that constitute this scale.

The results showed an improvement of all the evaluated variables when we used the cream with silver sulfadiazine, vitamin A, and lidocaine as treatment [6]. In all the scars treated in this way, we observed a greater percentage decrease of the surface area as compared with those treated with the cream without active principles. In addition, the scars treated with silver sulfadiazine, vitamin A, and lidocaine obtained a lower POSAS score, associated with a better scar quality. Such decrease in the POSAS score throughout the treatment is indicative not only of a more positive perception by the patient of the healing process but also of improvement of all the parameters evaluated: pain, itching, color, stiffness, thickness, and irregular scarring [7]. Therefore, our results indicate that performing a topical treatment with a cream containing silver sulfadiazine, vitamin A, and lidocaine from the beginning of treatment decreases wound size faster, improves the quality of the scar and the overall perception of the patients. In other words, such a treatment of postcosmetic surgery scars yields better esthetic and functional outcomes [8].

3. Combining skin substitutes for dermal reconstruction

The other treatment we are concerned with involves using different dermal substitutes in reconstructive surgery. Soft tissue impairment after an accident requires fast radical treatment and often multiple surgical procedures related to necrotic and poorly perfused tissue. Traditionally, dermal reconstruction meant harvesting grafts and flaps, which left major sequelae in donor sites. However, modern understanding of the composition of the skin has enabled researchers to develop numerous cutaneous substitutes which allow for the reconstruction of the dermis by providing a scaffold that promotes new tissue growth, thus compensating for the functional and physiological impairments caused by damaged tissue. Moreover, they offer the attractive possibility of employing grafts to treat large burns.

Skin substitutes are biomatrices that may be used to replace the damaged epidermis or dermis (or both) partially or totally, transitory or definitively. Although they can be classified in different ways [9], they fall broadly into two groups, either decellularized dermis derived from human or animal sources or artificially constructed scaffolds comprised of highly purified biomaterials or synthetic polymers. Many of these substitutes act by guiding the patient's own cells to form a neodermis, both reducing pain and improving healing by avoiding excessive scarring [10]. They allow practitioners to create a controlled environment appropriate for physiology and cellular function, as well as to identify and properly manipulate the cells so that parenchyma, stroma, and vascular components are generated, and to produce materials malleable by the cells.

One such cutaneous substitute is Integra®, which consists of a matrix of purified collagen from bovine tendon cross-linked with glycosaminoglycan obtained from shark cartilage and a silicone layer that functions as a temporary epidermis. It is a bilayer membrane system, consisting of an inner dermal substitute layer and a temporary outer epidermal substance layer. The inner layer is composed of a three-dimensional matrix of cross-linked bovine tendon collagen plus a glycosaminoglycan, and the outer layer is made of silicone. Integra® was introduced by Burke and Yannas in the early 1980s. The aim of their research was to find a substitute for the skin of patients with massive burns [11]. Nowadays, Integra® is a fundamental part of the "reconstructive ladder" and is utilized for treating skin loss resulting from burns, trauma and oncologic and pressure sore surgery [12]. After application of Integra®, the patient's native fibroblasts, macrophages, and lymphocytes infiltrate and new capillary growth occurs into the matrix of the inner layer. The inner layer becomes degraded and an endogenous collagen matrix is deposited by the patient's

own fibroblasts, forming a neodermis. Once engraftment is complete, 2–3 weeks after application, the outer silicone layer needs to be removed and an epidermal autograft must be placed over the neodermis. One of the advantages of this process is that successful neodermis formation requires only a thin skin graft which provides epidermal coverage which also prevents infections. Furthermore, as no donor site is created, it eliminates the risk of donor site wound complications.

Another skin substitute is cadaver skin or homograft, which was included in protocols for the first time in the year 1981 in Philadelphia, United States. By virtue of the processing of cadaver skin through a skin bank, a suitable substitute is obtained and distributed to potential receptors [13]. Depending on the way in which they are processed, these "acellular dermal homografts" (as Takami describes them [14]) can be used transiently or permanently. To reduce the probability of graft rejection, cadaveric grafts undergo a cell-removal process and the resulting acellular tissue is irradiated with gamma rays, which destroy the immunogenic potential of the tissue. Employing cadaver skin to treat severe trauma of lower limbs with skin impairment has a number of advantages. To begin with, this treatment produces a biological closure after escharectomy. Furthermore, it helps reduce the loss of fluids, proteins, and electrolytes, as well as the pain experienced by the patient. Apart from this, it prevents the desiccation of the wound bed, since it functions as a biological cover for complex wounds, ultimately improving the preparation of the wound bed before definite reconstruction [15]. Finally, the addition of artificial skin over the vascularized homologous dermis creates a dermal structure of greater thickness and elasticity.

Another recent development which is of great importance for reconstructive surgery is vacuum therapy (VAC), which improves wound healing by means of two main mechanisms. In the first place, it acts on the interstitial level eliminating edema, inflammatory mediators, and bacteria. It thus combats the vicious cycle of increased interstitial edema and pressure, cell death, and necrosis which is begotten by the inflammatory response triggered after a lesion. In addition, this treatment promotes mitogenesis and granulation tissue formation [16]. VAC is relevant to our research since, as Morykwas explains, it can be used to help incorporate Integra® and skin grafts as permanent replacements. Using a vacuum system after the escharectomy and the homograft placement and 1 week after positioning the artificial skin and the ultrathin autograft favors the arrest of these two substitutes. Moreover, negative pressure wound therapy can help augment the healing process and prepare the wound for definitive closure. A review published in Cochrane in 2007 [21] reported that, after 6 months of treatment, a 71% success rate had been observed in wounds treated with both artificial skin and negative pressure through

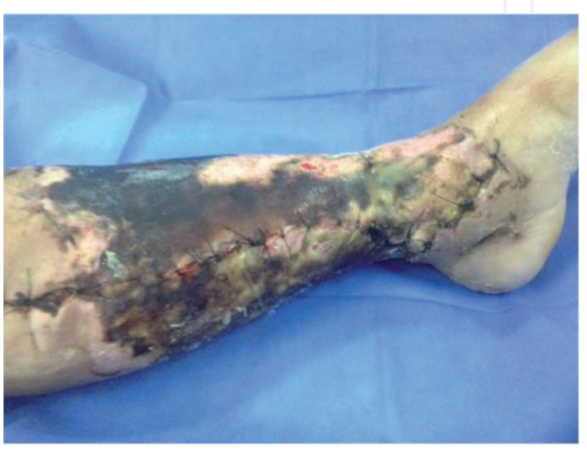

Figure 9.
Full-thickness trauma in lower limbs.

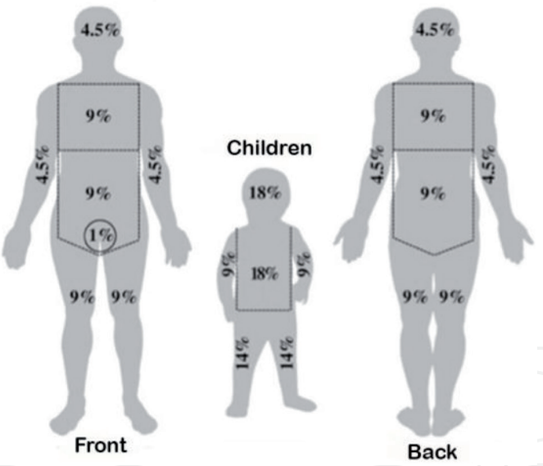

Figure 10.
Pulaski and Tennison's Rules of Nines.

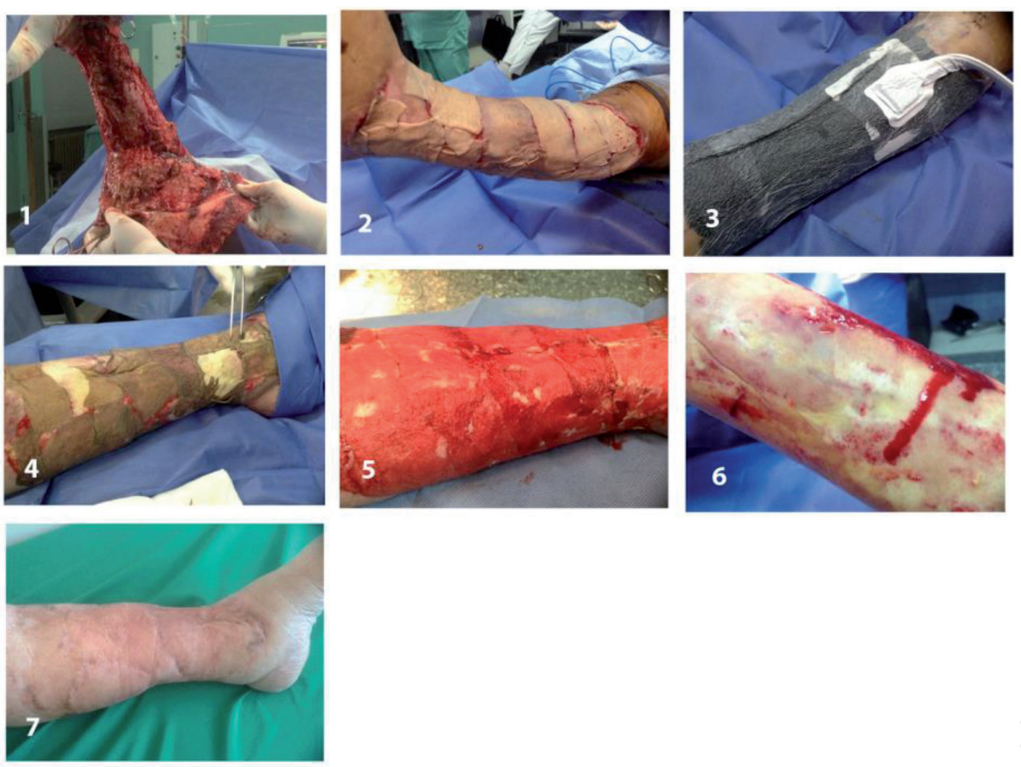

Figure 11.
(1) Escharectomy, (2) cadaver skin, (3) vacuum system, (4) epidermolysis, (5) neovascularized homodermis, and (6) artificial skin over vascularized homodermis—final result with autograft.

a vacuum system, whereas the success rate of wounds treated solely with negative pressure had been, at 37%, significantly lower. In terms of wound healing, even better results were obtained when Integra® was used as a dermal substitute [22].

As a consequence of the benefits we have mentioned, dermal substitutes have now been extended to treat other pathologies. Furthermore, the use of cutaneous substitutes added to the vacuum therapy has been incorporated into the "Modified Ladder of Reconstruction" [17]. However, the usefulness of treating large wounds with deep skin impairment with both cadaver skin and artificial skins has not been, to date, exhaustively studied. Therefore, we wish to contribute to this line of research by reporting the successful esthetic and functional results we have obtained when treating extensive skin lesions with both substitutes. Our study involved the follow-up of the wound healing of four patients (N:4) who had suffered high impact trauma in their lower

Grade	Definition
Grade 1	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions Allowed therapeutic regiments are: drugs and antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside
Grade 2	Requiring pharmacological treatment with drugs other than such allowed for grade 1 complications. Blood transfusions and total parenteral nutrition are also included
Grade 3	Requiring surgical, endoscopic, or radiological intervention
Grade 3a	Intervention not under general anesthesia
Grade 3b	Intervention under general anesthesia
Grade 4	Life-threatening complications including brain hemorrhage, ischemic stroke, subarachnoid bleeding, and central nervous system complications (but excluding transient ischemic attacks) requiring intermediate care or intensive care unit management
Grade 4a	Single organ dysfunction (including dialysis)
Grade 4b	Multiorgan dysfunction
Grade 5	Death of a patient
Suffix "d"	If the patient suffers from a complication at the time of discharge, the suffix "d" (for "disability") is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication

Table 7.
Dindo classification of surgical complications.

limbs (**Figure 9**) and who were treated at Hospital Alemán in the city of Buenos Aires. All of them were females with ages ranging from 19 to 73 years (median: 32 years). All of their lesions belonged to Group 4 of Benaim's severity classification and ranked as full-thickness burns in Benaim's depth classification [18]. The affected body surface was calculated based on the rule of nines described by Pulaski and Tennison in 1949 [19] (**Figure 10**) with the following results: 8% in the 19-year-old patient, 24% in the 22-year-old, 28% in the 43-year-old, and 8% in the 73-year-old (**Table 4**).

In all cases, escharectomy was performed on fascia within the first 48 h of the accident. Immediately afterward, the wounds were covered with cadaver skin from the tissue bank. Over the next 5–9 days, epidermolysis was observed (i.e., spontaneous removal of the epidermis), as well as vascularization and arrest of the homologous dermis on the receptor bed. In the second stage, the artificial skin was placed on the built-in vascularized homologous dermis. Once the artificial skin had been placed, we waited for 21 days before removing the silicone layer and completing the third and last surgical stage with the placement of a 1/4-thick autograft, obtained with an electric dermatome, over the heterologous vascularized neodermis. **Figure 11** illustrates the procedure we followed and the results we obtained.

We used a grid of manual design to evaluate the arrest of the cadaver and artificial skin (expressed in percentages). The arrest of the cadaver skin was of 95% and the placement of the heterologous matrix with an ultrathin autograft was of 94%. The average hospital time was 46 days. No major complications were present, but only minimal difficulties belonging to grades 3b, 4, and 5 of the Dindo and Clavien table [20] (**Table 7**). After a year of follow-up, we observed that favorable functional results had been obtained in highly complex articular areas such as ankles or knees due to the contribution of homologous and heterologous matrixes that provided adequate scaffolding. With respect to the esthetic results, no depression of the covered surfaces was observed with respect to the adjacent normal dermal tissue. Furthermore, there was no evidence of pathological scarring (such as keloids or hypertrophic scars).

4. Conclusions

The goal of any healing process is not only that the scar does not bring about functional disruptions, but also that it is as inconspicuous as possible. Patients of both cosmetic and reconstructive surgery expect scars that do not stand out from the normal surrounding skin, yet there is no consensus among medical practitioners as to which healing methods can achieve both functional and esthetic goals most effectively. In this chapter, we have accounted for two studies carried out at Hospital Alemán in the city of Buenos Aires, the promising results of which may help practitioners arrive at a standard for treating scars resulting from cosmetic and reconstructive surgery.

Regarding postcosmetic surgery scars, we have tested the progress of the scars of 32 patients, each having two postsurgical scars that were treated with two different creams. The results of our research show that performing a topical treatment with a cream that contains silver sulfadiazine, vitamin A, and lidocaine from the onset of the treatment decreases the size of the wound more quickly, improves the quality of the scar and the patient's perception of it. These findings contrast with the less positive outcome of the scars treated with a moisturizing cream without active ingredients [23]. Thus, we conclude that using creams with active ingredients should be promoted as a common practice.

In turn, in our study related to reconstructive surgery, we followed the progress of four patients whose massive skin loss was treated with a combination of artificial and cadaveric dermal substitutes. Using modern biotechnology to reconstruct damaged structures and to provide a new extracellular matrix constitutes the greatest breakthrough in reconstructive surgery of recent times. The development of homografts and artificial skin has allowed professionals to accelerate healing by covering wounds transitorily or permanently. At the same time, they work as a barrier against infections, help maintain the hydroelectrolytic balance [24], and improve esthetic and functional results. As we explained in the previous section, the quality of the scar and the properties of the neodermis depend on the use of an appropriate extracellular matrix [25].

As part of our research, we assessed the progress of the four patients' scars, focusing on such characteristics as color, thickness, volume, and pain, as well as on the restoration of function at affected sites. We noted positive outcomes in all evaluated parameters, which points at the advantages entailed in implementing this technique. Moreover, the number of hypertrophic scars was lower than the average. Our method fulfilled the ultimate goal of tissue engineering, namely, to restore damaged or lost tissue in traumatic wounds that result in a functional barrier, providing, at the same time, for rapid closure to prevent dehydration and bacterial infection. As attested by our results, the advantages of combining both dermal substitutes include better functional and esthetic outcomes, pain relief, and enhancement of the overall quality of the scar.

All in all, the results of both studies are indicative of the direction that modern scar treatment can take in order to achieve the desired goals in both cosmetic and reconstructive surgery. In the case of the former, achieving an esthetically pleasing scar has long been recognized as a fundamental requirement of a successful intervention. Here, the most optimal results can be achieved if wound treatment and care are initiated early. However, the esthetic factor should not be limited to this type of procedures. Our work on reconstructive surgery centers around the concept that such surgery should not only merely aim at "rebuilding" but also at obtaining the best functional and esthetic outcome with the least possible number of interventions. Recent advances in biotechnology offer us effective skin substitutes, which can be combined so as to achieve a better evolution of the wounds. [26] Such improved esthetic and functional results in posttraumatic reconstructive surgery ensure an ad integrum recovery of the affected areas, which, ultimately, enhances the quality of patients' lives.

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