INTERNATIONAL JOURNAL OF COSMETIC SURGERY and AESTHETIC DERMATOLOGY
Volume 5, Number 2, 2003

Dermal Improvement via Aquapressure: DIVA Protocol

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ABSTRACT

A new and innovative combined technique is now available to improve the skin texture and rejuvenate the skin. The principle involves a very superficial abrasion of the stratum corneum with fruit pit powder followed by projection of a very powerful microjet of water containing active principles including antioxidants, moisturizing agents, and other ingredients. Biopsies and clinical studies show improvement in the skin, proving that it is not necessary to create a dermal wound to obtain dermal modification.

INTRODUCTION

THE KNOWN ALTERNATIVE METHODS (laser, peeling, etc.) used to resurface the skin allow regeneration of the dermal and epidermal components by means of cicatrization from remaining cells.

The biological repair process varies according to the depth level reached. The purpose of the dermal improvement via aquapressure (DIVA) process is not to obtain cicatrization but rejuvenation of the tissues. After simple elimination of the corneous and superficial layers, mechanical stimulation by hyperpressure with antioxidant-loaded water will lead to dermal modifications. This non-invasive technique shows that it is not necessary to create a dermal wound to obtain dermal modification.[1]

CONCEPTS

DIVA is a method that associates two techniques that have in common stimulation of the dermis: by molecular and mechanical action. The material used is a device that combines microabrasion and liquid hyperpressure. This new patented device called Water-Beam (Medicamat S.A., France) works with two different hand-pieces: one with abrasive powder and one with a high-pressure water brush.

The first technique used is microepidermabrasion (Fig. 1). This soft abrasion, practically painless and achieved without local anesthesia, involves projecting biological abrasive powder made of fruit pits, instead of aluminium hydroxide microcrystals. The fruit pit powder used has a particle size between 110 and 140 μm and is instantly sucked in a waste canister. A superficial abrasion of the stratum corneum, and often of the stratum granulosum, will be achieved; the basal and spinosum layers are not touched.

The second step involves water hyperpressure: projection over the skin, and with high pressure, of plain water or physiological saline solution. Known for years in industry for cutting plastics or metals, the water jet cutting method has had surgical applications on soft tissues such as the liver. In this new applica-

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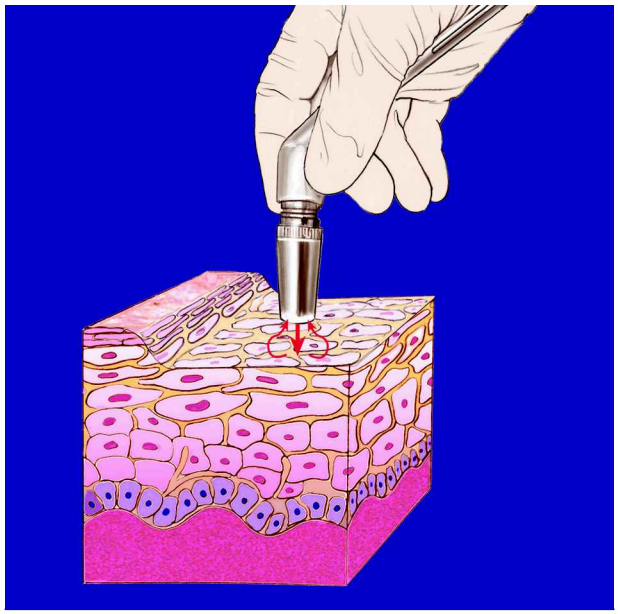

FIG. 1. DIVA protocol of microepidermabrasion is achieved with projecting biological abrasive powders; the basal and spinosum layers are not touched.

tion, the power used is greater because the skin is very elastic. A hand piece with different nozzles brings the products under pressure; this water is immediately captured by the adjacent vacuum system.

The power of this method is calculated to be at the limit of the cut or frank abrasion without, however, any risk of skin perforation. The power used is between 15 and 18 bars: skin perforation occurs at approximately 20 bars. The vacuum has the sole purpose of capturing the water and skin scraps. The microjet used is a 5 mm water paint brush passed over the zones to be treated. Used alone, the efficacy of the water pressure is limited. We obtained excellent clearing of the skin and suppression of blackheads (Figs. 2, 3).

More interesting is that the stratum corneum is unharmed to the high water pressure; the skin was not damaged by the aquabrasion, which proves the adequate cohesion of the corneocytes.

Water projection over a fragile epidermis after microepidermabrasion results in transcutaneous absorption. This is desirable because the water, as a moleculular vehicle, allows the active agents to penetrate the epidermis (Fig 4). The results of four different DIVA protocols each different, are reviewed below.

RESULTS

Lidocaine

This test demonstrates the molecular penetration of lidocaine by hyperpressure. First, the classic epidermabrasion eliminates the stratum corneum. Then, I performed an epicritical cutaneous test with a needle, revealing a stronger sensitivity at the center of the abrasion than at the sides of the area. This indicates an irritation of the nerve-free intraepidermal termination (Fig. 5). Next, three doses of lidocaine are injected in the physiological serum reservoir and the microjet is propelled over the previously abraded surface. The result obtained is hypoesthesia of the treated surface, demonstrating that the lidocaine molecules did penetrate intraepidermally. If the needle is inserted more deeply, the patient feels a little pain. This indicates that the molecular penetration did not traverse the dermoepidermal membrane.

FIG. 2. Before treatment: cohesion of the stratum corneum and blackhead composed of lipidic substances and keratinocyte scraps.

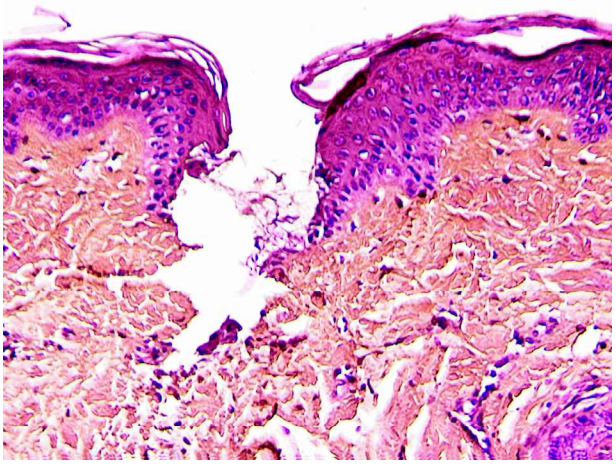

FIG. 3. After water pressure: the force is such that it allows extraction of the blackhead and elimination of dead cells. The stratum corneum is unharmed by the high water pressure.

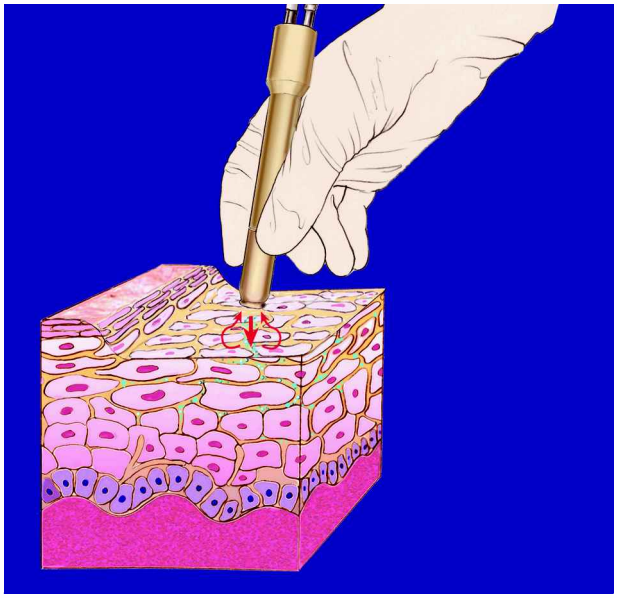

FIG. 4. Water projection after microepidermabrasion results in transcutaneous absorption.

Cutaneous penetration

To demonstrate the depth reached by the molecules, I performed a clinical test using china ink with carbon as a indicator. The histological results are revealing. One can note the ablation of stratum corneum as well as the superficial part of the epiderm. The voluminous carbon molecules penetrated the basal epidermis as if they had gone through the interkeratinocyte desmosomes. The dermoepidermal membrane was untouched, as if it had been an obstacle.

There is also no trace of keratinocytes inside the dermis. The carbon molecules penetrated zones of lesser resistance without damaging this basal epithelium. It is interesting to note that if we abrade the epidermis more completely, the carbon molecules can even penetrate the superficial dermis after microjet treatment (Fig. 6).

This experience is the irrefutable proof of

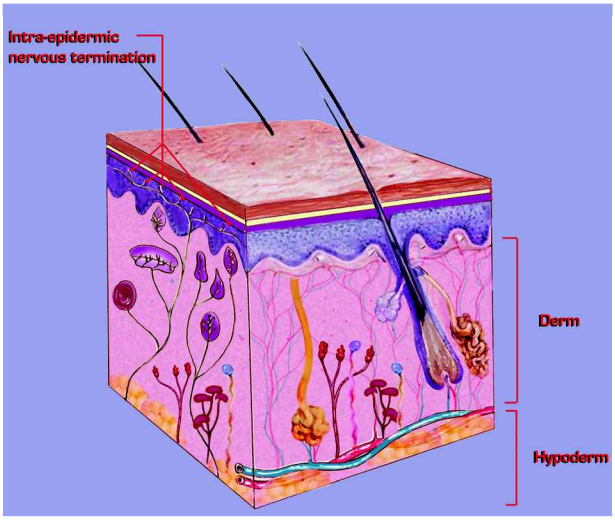

FIG. 5. Note the nerve-free intraepidermal terminations.

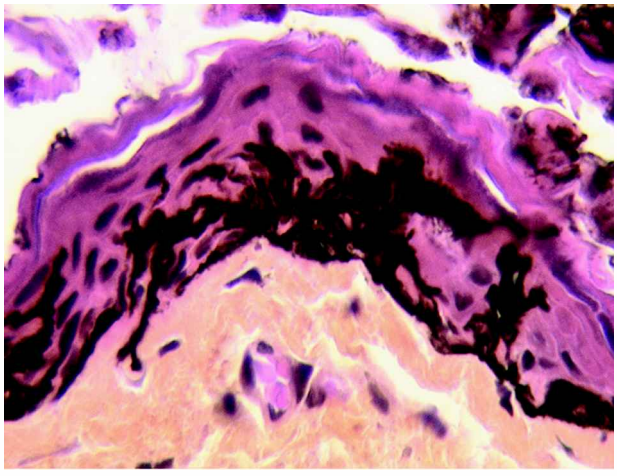

FIG. 6. Carbon molecules penetrate by hyperpressure through zones of lesser resistance without damaging the basal epithelium.

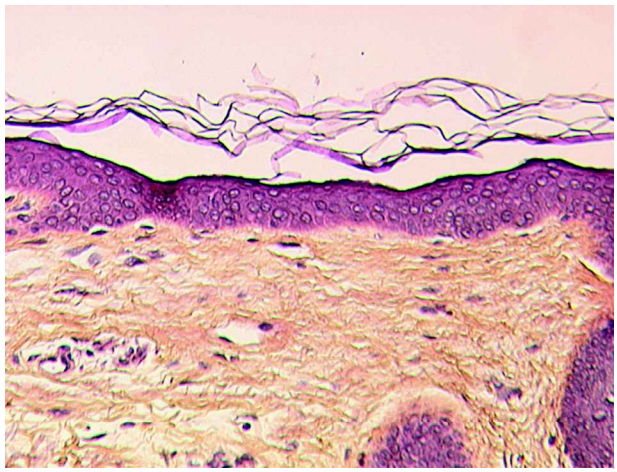

FIG. 7. Skin biopsy in a male patient before treatment.

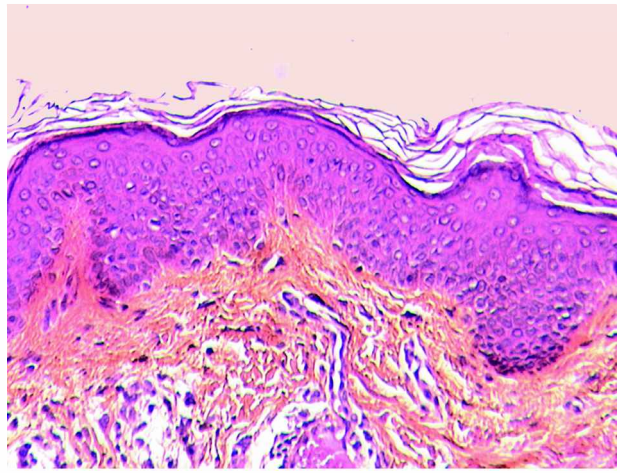

FIG. 8. Biopsy in a male patient after five DIVA passages.

penetration of active agents by water pressure after the stratum corneum has been abraded.

Histological protocol

To appreciate the histological modifications after treatment with DIVA, I performed two biopsies on two patients before treatment and after five treatments. The biopsy results show not only a normalization of the stratum corneum and its network, but also a thickening of the epidermis[2] and the reappearance of the papillary dermal crests (Figs. 7–10).

Chemical protocol

The goal of a chemical protocol performed on two types of skin was to compare the efficiency of microjet after abrasion in sample skins. Different histological and biochemical parameters were studied, using an experimental sample of skin that was kept alive.

Histological evaluation of glycosaminoglycans was achieved through Hales's dye. A semiquantitative evaluation using scores provides evidence for eventual modifications in the quantity of glycosaminoglycans in the dermis. We observed that the intensity scores of

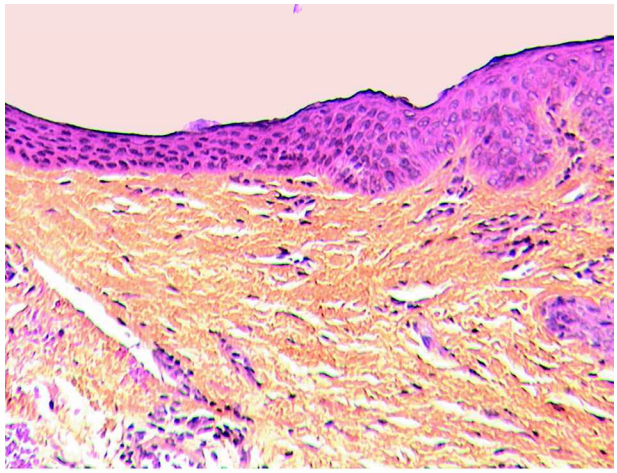

FIG. 9. Biopsy in a female patient before treatment.

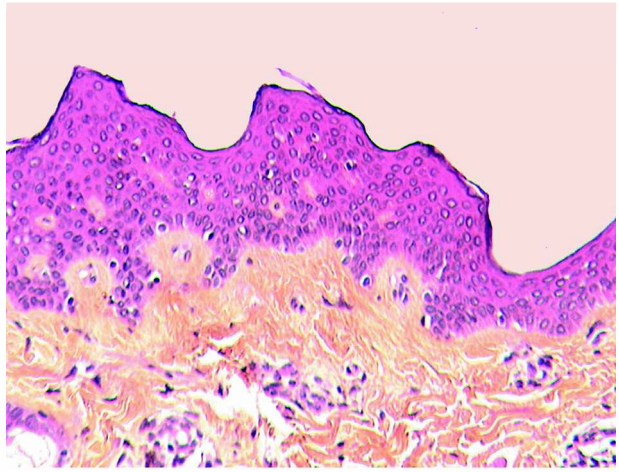

FIG. 10. Biopsy in a female patient after five DIVA passages.

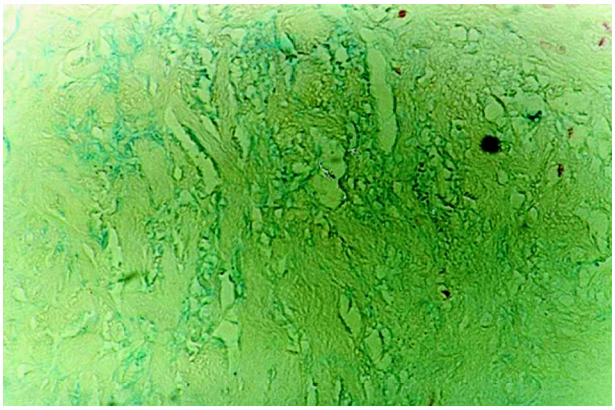

FIG. 11. Before treatment, blue coloration indicates presence of glycosaminoglycans.

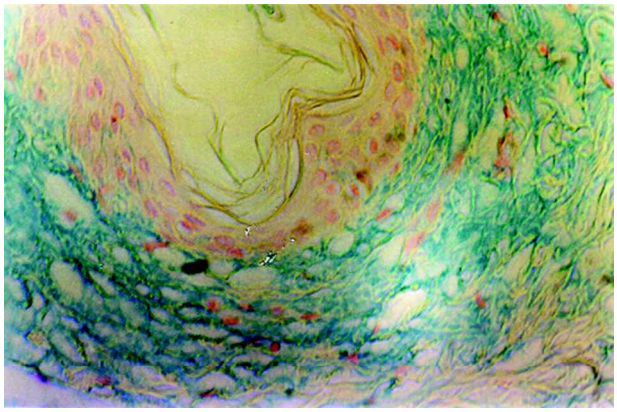

FIG. 12. After treatment, a bright blue coloration indicates a glycosaminoglycans synthesis potentialized by the microjet.

the dye in the presence of glycosaminoglycans are greater for abraded skin with the microjet. One observes in this case a bright blue coloration, which indicates the presence of glycosaminoglycans, the sponges of the dermis that ensure its hydration (Figs. 11, 12).

The dosage of collagen synthesis was evaluated with tritium proline added to the culture fluid. Our aim was to evaluate the antiaging efficacy of a formula containing 0.05% retinaldehyde and pretocopheryl (Ystheal). The results show an increase in the incorporation of tritium proline at the dermal fibroblasts treated with Ystheal after abrasion, in comparison with both sample skin and untreated abraded skin. The microjet seems to have potentialized the effect of the abrasion, since this combination showed the highest collagen synthesis (Table 1).

DISCUSSION

DIVA combines two complementary and interactive technologies. The first—microabrasion—has been known for some time and is experiencing a renewal of interest because of its low morbidity and good results. The other, however, is new. This new method of transcutaneous penetration opens many possibilities as far as the molecules to be used. During the different protocols examined, I first eliminated any chemical agent to avoid a disguised peeling. My choice tended towards antiradical substances. The aggression of the free radicals is a major factor in skin aging. The skin includes a conjunctive dermis with low endogenous antiradical defenses and enzymatic systems.

Applying topically substances with antiradical properties is useful to compensate the lack of these substances and also to act directly on skin aging. We know aging is induced by ultraviolet solar radiation. It can also result from the progressive and ineluctable natural degradation of cutaneous structures. The antiradicals used included a mixture of vitamins A and C, along with oligoelements (zinc and silicium). Determining the ingredients and the balance between normally recommended doses is difficult. There might also exist eventual interactions between various substances. Yet studies in humans are sparse, and their protocols vary greatly, which makes the results difficult to compare. A study is presently in process involving daily application of a vitamin and oligoelement-based cream between each DIVA

TABLE 1. DOSAGE OF COLLAGEN SYNTHESIS BY WEBSTER TECHNIQUE

–Abrasion + microjet + Ystheal® cream: 2168 cpm/mg
–Abrasion + Ystheal® cream: 1640 cpm/mg
–Abrasion only: 1157 cpm/mg
–No abrasion witness skin: 1242 cpm/mg

FIG. 13. A 28-year-old woman with acne scars before treatment (**left**) and after 5 weekly DIVA treatments (**right**).

treatment. A modification of the dermis by activation of the fibroblasts, augmentation of collagen synthesis, and augmentation of dermal hydration can be observed.

CONCLUSION

DIVA modifies the dermis by its epidermal action. The Water-Beam biological technique using water, fruit, vitamins, and oligoelements has various advantages: (Figs 13, 14).

- superficial wrinkle treatment
- improvement of the quality of the skin
- improvement of skin moisture
- penetration of molecules with potentialization of their action

Another advantage is the possibility of use by

FIG. 14. A 55-year-old woman before treatment (**left**) and after 4 weekly DIVA treatments (**right**).

each practician according to his or her experience and preferences with antioxidants (or others) that will act directly inside the epidermis homogeneously. This treatment can in no way replace other resurfacing techniques such as laser for the treatment of deep wrinkles, for example.

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