

# Clinical Evaluation of a Novel Glycolic Acid/Antioxidant–Based Antiaging Skin Care Regimen

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A novel physician-dispensed glycolic acid/antioxidant–based topical skin care regimen consisting of an exfoliating facial cleanser, a daily antioxidant facial serum, a night renewal facial cream, and a revitalizing eye cream was evaluated with regard to its impact on skin surface hydration, fine lines, and tactile roughness.

This was an open-label, single-center, observer-blinded trial. The study population consisted of 24 women, aged 35 to 55 years, with mild to moderate facial photodamage. Following a 3-day pretrial conditioning period, subjects used the 4-product topical skin care regimen, as instructed, for 3 weeks. Efficacy parameters included periodic dermatologist and expert grader evaluations, skin surface hydration, and subject self-evaluation. Adverse events, if any, were also recorded.

The mean age of the 24 subjects was 45.4 years; 23 of the 24 subjects (96%) completed the study. As assessed by both a dermatologist and an expert grader, there were significant reductions versus baseline in fine lines, dryness, and tactile roughness approximately 15 minutes after a single application of 2 products from the treatment regimen (the revitalizing eye cream and the daily antioxidant facial serum). Modest additional improvements were reported by the dermatologist, and significant improvements were reported by the expert grader, after 3 weeks of treatment with all 4 products. Skin surface hydration measured by electrical conductance also was improved significantly immediately after application of 2 of the 4 products and after the 3-week course of treatment. Subject satisfaction, as assessed by a posttreatment questionnaire, was high, and no adverse events were reported.

This glycolic acid/antioxidant–based 4-product topical regimen is a safe and efficacious option for patients who want to minimize the signs of photoaging.

Our hedonistic impulse to diminish the signs of chronologic aging and photoaging has fostered a burgeoning cosmetics industry. According to the American Society for Aesthetic Plastic Surgery, in

2006 Americans spent just under \$12.2 billion on cosmetic procedures.<sup>1</sup> Of the nearly 11.5 million surgical and nonsurgical procedures performed in the United States in 2006, nonsurgical procedures comprised 83% of the total.<sup>1</sup> Although women continue to be the primary users (>10.5 million cosmetic procedures), the market for cosmetics-related procedures and products is increasing among men as well as among ethnic minorities.<sup>1-3</sup>

Modern antiaging cosmetics go well beyond the simple moisturizing function of traditional antiwrinkle creams. They perform complex functions in terms of skin protection, nourishment, and removal of superficial layers;

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additionally, incorporation of excipients and controlled-release carriers (eg, liposomes, nanosomes, etc) into antiaging formulations provides for slow release and long-lasting action.<sup>4</sup> Such topical products as cleansers, photoprotectants, exfoliators, and moisturizers and emollients are available to diminish fine lines and wrinkles, decrease redness, smooth texture, fade discoloration, and, in general, provide a more youthful appearance. Functional classes of ingredients contained in these products include antioxidants, growth factors, peptides, anti-inflammatories and botanicals, polysaccharides, and pigment-lightening agents.<sup>4,5</sup>

Channels of distribution of professional skin care products include retail outlets (department stores, specialty stores, and the Internet), spas and salons, and medical care providers and medical spas. Although retail outlets retain a sizeable share of the market, the medical care provider's share of the market is increasing. With the plethora of retail products available and the extent of unsubstantiated and unregulated claims attesting to product efficacy, patients often consult their physicians (primarily dermatologists or, if they have undergone cosmetic procedures, plastic surgeons) to understand and avail themselves of noninvasive cosmetic products and procedures. An added advantage of using physician-dispensed products is that there may be regulatory restrictions (eg, restrictions imposed by the US Food and Drug Administration) on the concentration of certain ingredients that can be included in over-the-counter (OTC) products. One such example is  $\alpha$ -hydroxy acids (AHAs), which were the first molecules to start the cosmeceutical revolution. Two factors determine their efficacy: concentration and the pH of the preparation. The active ingredient in the preparation is the free acid, and the pH of the preparation determines the proportion of free acid. According to the Cosmetic Ingredient Review recommendations, the concentration of AHAs in OTC cosmetics cannot exceed 10%, and the pH of the preparation cannot be less than 3.5.<sup>6</sup> Consequently, these OTC preparations can offer only modest improvement at best. In contrast, the concentration of AHAs in physician-dispensed products may exceed 10%.

GLX (glycolic acid/antioxidant) Technology is a proprietary technology that is a unique blend of AHAs (glycolic acid and ammonium glycolate) and natural antioxidants. The formula matrix is designed to act as a catalyst for penetration of the distinctive blend of AHAs and natural antioxidants, which enhances the skin's natural production of hyaluronic acid and epidermal growth factor, stimulates collagen, and protects epidermal cells.

This article reports on a study undertaken to evaluate the efficacy and tolerability of a novel skin care regimen that

incorporates GLX Technology with regard to its impact on the condition of facial skin during a 3-week period.

## MATERIALS AND METHODS

Vivité is a physician-dispensed product whose core system includes an exfoliating facial cleanser, a daily antioxidant facial serum, a night renewal facial cream, and a revitalizing eye cream. The functional class of agents and the specific ingredients are included in Table 1.

## STUDY DESIGN

This study, conducted in the late spring and early summer of 2006, was an open-label, single-center, observer-blinded trial. Twenty-four healthy volunteers, aged 35 to 55 years, exhibiting mild to moderate facial photodamage were recruited for participation in this trial. Inclusion and exclusion criteria are detailed in Table 2. The study was conducted in accordance with current Good Clinical Practices, current Good Laboratory Practices, and the COLIPA Guidelines for the Evaluation of the Efficacy of Cosmetic Products.

## TREATMENT REGIMEN

Prior to study initiation, all subjects underwent a 3-day pretrial conditioning period, during which they stopped the use of all moisturizing products on the face. Following the conditioning period, subjects were given a skin care regimen comprised of 4 topical products to be used as directed for a 3-week period: an exfoliating facial cleanser to be applied once every 3 days in the evening, an antioxidant facial serum to be applied once daily, a renewal facial cream to be applied once every night, and a revitalizing eye cream to be applied twice daily. Subjects were allowed to use their current facial cleansers on the 4 days of the week when they were not using the exfoliating cleanser, but they were not allowed to use any new cleansers during the study period. Subjects were required not to use any other moisturizers or topical medications, toners, or astringent products on the face during the study; established makeup regimens could be continued, although subjects were not allowed to change brands of makeup during the study. Subjects were instructed to avoid excessive sun exposure, and the use of tanning beds was prohibited.

Each subject's initial morning treatment regimen was performed at the laboratory under the supervision of study staff to ensure adherence to the instructions for use. In addition, all subjects returned to the laboratory on day 2 as well as on the days of their scheduled week 1 and week 2 assessments and completed their morning treatment regimens under supervision. Subjects were provided with a diary form to record the times of their product applications.

TABLE 1

## Components of a Glycolic Acid/Antioxidant–Based Antiaging Skin Care Regimen

| Product                        | Functionality and Constituents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Exfoliating facial cleanser    | Antiaging/exfoliation: glycolic acid, ammonium glycolate, and salicylic acid<br>Physical exfoliation: polyethylene spheres<br>Anti-irritant: sucrose polysoyate, PEG-120 methyl glucose dioleate, and Di-PPG-2 myreth-10 adipate<br>Humectant: sericin and <i>Cassia angustifolia</i> seed polysaccharide                                                                                                                                                                                                                                                                                                                                                        |
| Daily antioxidant facial serum | Antiaging actives: glycolic acid, ammonium glycolate, and natural antioxidants<br>Antioxidant actives: olive leaf extract, <i>Camellia oleifera</i> leaf extract, and <i>Punica granatum</i> extract<br>Anti-inflammatory actives: licorice extract, chamomile extract, <i>Aloe barbadensis</i> leaf extract, and yeast extract<br>Humectant: glycerin, sodium PCA, urea, trehalose, sodium hyaluronate, phospholipids, butylene glycol, <i>Stevia rebaudiana</i> (sweet honey leaf) extract, <i>C. angustifolia</i> seed polysaccharide, and mannitol<br>Emollients: bis-hydroxyethoxypropyl dimethicone, phenyl trimethicone, cyclomethicone, and dimethiconol |
| Night renewal facial cream     | Antiaging: glycolic acid, ammonium glycolate, and natural antioxidants<br>Skin firming: algae extract<br>Humectants: glycerin, sodium PCA, urea, trehalose, sodium hyaluronate, pentylene glycol, saccharide isomerate, and sericin<br>Emollients: bis-hydroxyethoxypropyl dimethicone, cyclomethicone, cyclopentasiloxane, dimethicone crosspolymer, octyldodecanol, hydrogenated cocoglycerides, and <i>Irvingia gabonensis</i> kernel butter (wild mango)<br>Antioxidant: superoxide dismutase, olive leaf extract, tocopherol, and magnesium ascorbyl phosphate                                                                                              |
| Revitalizing eye cream         | Antiaging: glycolic acid, ammonium glycolate, and natural antioxidants<br>Reduce puffiness: caffeine<br>Tightening: palmitoyl tripeptide-3 and <i>Ceratonia siliqua</i> gum<br>Interference pearls: titanium dioxide, iron oxides, and silica<br>Humectants: glycerin, phospholipids, carrageenans ( <i>Chondrus crispus</i> ), hydrolyzed wheat gluten, and glucose<br>Emollients: phenyl trimethicone, cyclomethicone, and dimethiconol                                                                                                                                                                                                                        |

### OUTCOMES MEASURES

Efficacy assessments were performed according to the schedule summarized in Table 3.

### DERMATOLOGIST AND EXPERT GRADER EVALUATIONS

Dermatologist (investigator) evaluations and expert grader (professional with a significant amount of experience in cosmeceuticals research) evaluations of skin surface fine lines, dryness, and tactile roughness were scored qualitatively using 9-point scales. Fine lines or superficial wrinkles (ie, shallow indentations or lines) were graded as not visible or slightly visible (0–2),

moderately visible (3–5), and obvious or very marked (6–8). Visual assessments of skin dryness were recorded as none (0), mild to moderate flaking or scaling (1–5), and marked to severe scaling or fissuring (6–8). Tactile roughness was evaluated in terms of dryness, scaliness, wrinkles, and other surface irregularities. Tactile roughness was graded as normal to slight roughness (0–2), moderate roughness (3–5) and severe to extreme roughness (6–8). Discrete lesions, such as keratoses, nevi, and comedones, were not included when assigning grades 6 to 8. Photographs of the left side of the face were captured using a Canon EOS 20D digital camera.

TABLE 2

## Study Inclusion and Exclusion Criteria

| Inclusion Criteria                                                                                                                     | Exclusion Criteria                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Female, aged 35–55 y, in good general health                                                                                           | Pregnant or nursing, or planning a pregnancy during the study period                                                       |
| Mild to moderate photodamage on the face, as determined by an expert grader                                                            | Medical problems or poor general health                                                                                    |
| No participation in a study involving the face in the past 30 d                                                                        | Eczema, seborrheic dermatitis, psoriasis, or chapped skin                                                                  |
| Willing and able to follow all study directions                                                                                        | Use of medications that might interfere with the study results                                                             |
| Willing to discontinue use of all moisturizing products on the face 3 d before the first study visit and for the duration of the study | Known sensitivities to cosmetics, soaps, moisturizers, etc                                                                 |
|                                                                                                                                        | Known sensitivity to $\alpha$ -hydroxy acid                                                                                |
|                                                                                                                                        | Any other condition or factor that in the investigator's opinion may affect skin response or the interpretation of results |

**SKIN SURFACE HYDRATION**

Changes in skin surface hydration were measured utilizing an IBS Skicon-200 Conductance Meter equipped with a Measurement Technologies probe. The ability of an alternating current to flow through the stratum corneum is an indirect measure of stratum corneum water content.<sup>7</sup> For each measurement, a spring-loaded probe tip was placed at the sample site, and 2 to 3 seconds later alternating current conductance (expressed in units of millimho) was recorded. A total of 5 conductance measurements at each time point were obtained at each

site (suborbital and cheek areas), from which an average value for each site was computed.

**SUBJECT SELF-ASSESSMENT**

Subjects were asked to complete a 1-page self-assessment questionnaire at the conclusion of the study (week 3).

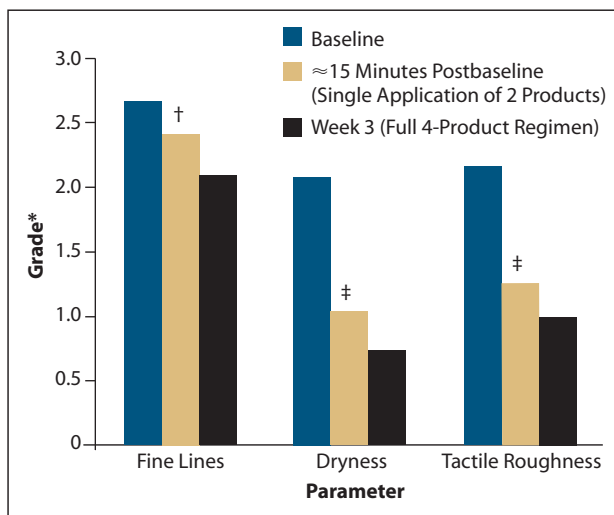
**ADVERSE EVENTS**

Tolerability was assessed 15 minutes postbaseline and after 1, 2, and 3 weeks. Subjects were observed as well as interviewed at each study visit to confirm tolerability

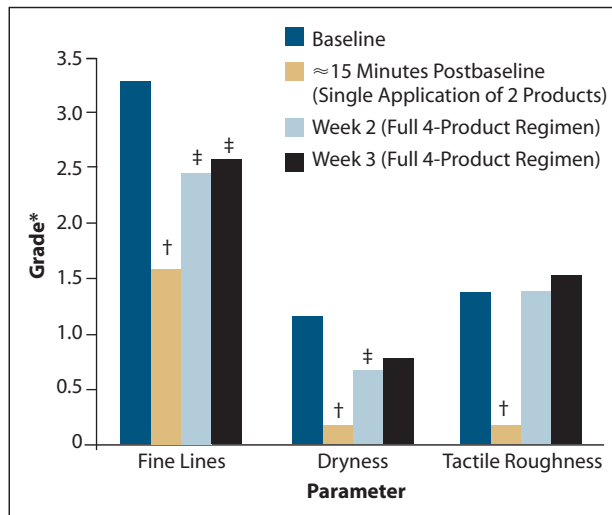
TABLE 3

## Efficacy Parameters and Timelines for Evaluation

| Parameter                                                                       | Timeline                                        |
|---------------------------------------------------------------------------------|-------------------------------------------------|
| Dermatologist evaluations (skin surface fine lines, dryness, tactile roughness) | Baseline; 15 min postbaseline; after 3 wk       |
| Expert grader evaluations (skin surface fine lines, dryness, tactile roughness) | Baseline; 15 min postbaseline; after 2 and 3 wk |
| Skin surface hydration (as determined by conductance measurements)              | Baseline; after 1, 2, and 3 wk                  |
| Subject self-evaluation                                                         | After 3 wk                                      |



**Figure 1.** Dermatologist evaluations of fine lines, dryness, and tactile roughness in subjects using a glycolic acid/antioxidant-based antiaging skin care regimen. Asterisk indicates scales for fine lines, where 0–2=slightly visible, 3–5=moderately visible, and 6–8=obvious or very marked; dryness, where 0=none, 1–5=mild to moderate flaking or scaling, and 6–8=severe scaling or fissuring; and tactile roughness, where 0–2=slight, 3–5=moderate, and 6–8=extreme; dagger,  $P<.05$  vs baseline; double dagger,  $P<.01$  vs baseline.



**Figure 2.** Expert grader evaluations of fine lines, dryness, and tactile roughness in subjects using a glycolic acid/antioxidant-based antiaging skin care regimen. Asterisk indicates scales for fine lines, where 0–2=slightly visible, 3–5=moderately visible, and 6–8=obvious or very marked; dryness, where 0=none, 1–5=mild to moderate flaking or scaling, and 6–8=severe scaling or fissuring; and tactile roughness, where 0–2=slight, 3–5=moderate, and 6–8=extreme; dagger,  $P<.01$  vs baseline; double dagger,  $P<.05$  vs baseline.

of the skin care regimen. Adverse events, whether or not they were considered to be related to the treatment regimen, were documented.

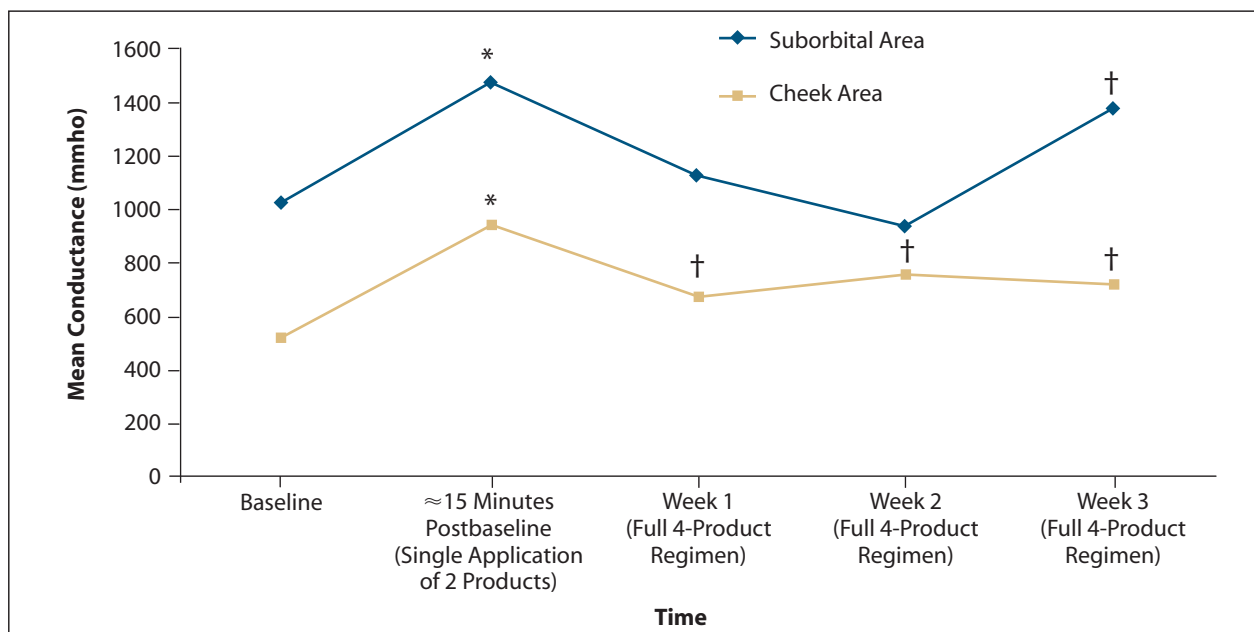
## STATISTICAL ANALYSIS

Dermatologist evaluations, expert grader evaluations, and conductance measurements at each of the follow-up

time points were compared with baseline values using paired  $t$  tests. A 2-tailed  $P<.05$  was taken as the level of significance for comparisons.

## RESULTS

Twenty-four healthy volunteers, aged 35 to 55 years, exhibiting mild to moderate facial photodamage



**Figure 3.** Changes in electrical conductance in the skin as an indication of skin hydration in subjects using a glycolic acid/antioxidant-based antiaging skin care regimen. Asterisk indicates  $P<.01$  vs baseline; dagger,  $P<.05$  vs baseline.

TABLE 4

### Subject Self-Assessment Following Treatment With a Glycolic Acid/Antioxidant–Based Skin Care Regimen

| Question                                                                  | Responses, %                 |             |                                     |
|---------------------------------------------------------------------------|------------------------------|-------------|-------------------------------------|
|                                                                           | Very Satisfied/<br>Satisfied | Indifferent | Very Dissatisfied<br>/Dissatisfied* |
| Did the products reduce the appearance of fine lines and wrinkles?        | 61                           | 35          | 4                                   |
| Did the products improve your skin's softness and smoothness?             | 96                           | 4           | 0                                   |
| Did the products improve your skin's radiance, tone, and clarity?         | 61                           | 39          | 0                                   |
| Did the products improve your skin's firmness, tightness, and elasticity? | 61                           | 35          | 4                                   |
| Did the products improve the texture of your sun-damaged skin?            | 61                           | 39          | 0                                   |
| Did the products improve your skin's overall appearance?                  | 83                           | 17          | 0                                   |
| Did the products improve your skin's overall health?                      | 70                           | 30          | 0                                   |

N=24.  
\*None of the subjects indicated "Very Dissatisfied" as a response.

participated in this trial. The mean age of the 24 subjects was 45.4 years; 23 of the 24 subjects (96%) completed the study. The efficacy of the GLX-based antiaging skin care regimen was evaluated based on qualitative skin surface visual assessments performed by a physician (dermatologist) and an expert grader, objective determination of skin surface hydration, and self-assessment by the subjects (Figures 1-3; Table 4). Digital photographs of the left side of the face at baseline and after the 3-week, 4-product skin care regimen are presented in Figure 4.

#### DERMATOLOGIST EVALUATIONS

Changes in the mean scores for fine lines, dryness, and tactile roughness observed with treatment, as determined by dermatologist evaluations, are presented in Figure 1. There was a significant reduction versus baseline in fine lines ( $P<.05$ ), dryness ( $P<.01$ ), and tactile roughness ( $P<.01$ ) approximately 15 minutes after a single application of 2 products from the treatment regimen (the revitalizing eye cream and the daily antioxidant facial serum). Continued treatment with the full 4-product

regimen during 3 weeks resulted in a further reduction in the mean scores for these parameters; however, the reduction was not statistically significant.

#### EXPERT GRADER EVALUATIONS

Changes in the mean scores for fine lines, dryness, and tactile roughness observed with treatment, as determined by expert grader evaluations, are shown in Figure 2. Scores for all 3 parameters were significantly reduced versus baseline ( $P<.01$  for all) approximately 15 minutes after a single application of 2 products from the treatment regimen (the revitalizing eye cream and the daily antioxidant facial serum). Significantly reduced scores versus baseline ( $P<.05$ ) were also seen for fine lines at weeks 2 and 3 and for dryness at week 2.

#### SKIN SURFACE HYDRATION

Changes in facial skin surface hydration observed during the treatment period are depicted in Figure 3. Electrical conductance measurements (higher conductance values correspond to greater hydration) revealed an immediate significant increase versus baseline ( $P<.01$ ) in facial skin



## Figure Not Available Online

**Figure 4.** Digital photographs of the left side of the face at baseline (A) and after 3 weeks of treatment with a glycolic acid/antioxidant-based antiaging skin care regimen (B).

hydration in the suborbital and cheek areas approximately 15 minutes after treatment with 2 products from the treatment regimen (the revitalizing eye cream and the daily antioxidant facial serum). Measurements in the cheek area also showed significant though more modest increases versus baseline ( $P < .05$ ) at weeks 1, 2, and 3. In the suborbital area, a significant increase versus baseline ( $P < .05$ ) was not seen again until week 3. It should be noted that the baseline conductance values for both areas were exceptionally high, indicating a high initial level of skin hydration.

## SUBJECT SELF-ASSESSMENT

Satisfaction results from the subject self-assessment questionnaire are detailed in Table 4. The majority of subjects were satisfied with the results of the 4-product topical skin care regimen in terms of the reduction of fine lines and wrinkles, the improvement of skin softness and smoothness, and the improvement of the overall appearance and health of their skin, among other parameters.

The subject self-assessment also included questions related to the subject's history of skin care product use. Twelve of the 23 subjects (52%) indicated they had tried other antiaging treatments in the past. (Eleven subjects had tried 1–3 treatments, and one subject had tried 4–6 treatments.) Of those subjects, 6 (50%) indicated that the current investigational regimen was as effective as or more effective than past treatments.

## COMMENT

This study involved a 3-week facial treatment regimen that included an exfoliating facial cleanser applied once every 3 days in the evening, an antioxidant facial serum applied once daily, a renewal facial cream applied once

every night, and a revitalizing eye cream applied twice daily. The GLX Technology on which these products are based offers the proven benefits of AHAs and the free radical protection of natural antioxidants. The 4 products contain ingredients that exfoliate the stratum corneum, safeguard epidermal cells, protect plasma lipoproteins, repair epidermal thinning, stimulate collagen deposition, enhance glycosaminoglycan production, increase epidermal growth factor, and provide sustained moisture release.

Significant increases in the understanding of the aging process have permitted effective interventions that may lead to therapeutic modalities that arrest the aging process, help cells retain the ability to perform their differentiated functions, and, in general, better protect the skin. The formula matrix in the products described in this study is designed to act as a catalyst for the deepest penetration of glycolic acid and natural antioxidants. It enhances the skin's natural production of hyaluronic acid, increases epidermal growth factor, stimulates collagen production, and protects epidermal cells. Three of the 4 products in this skin care regimen contain high concentrations of unbuffered and buffered glycolic acid (10%–20%) combined with antioxidants and plant extracts. The products are formulated to facilitate deep penetration of hydrating glycolic acid to improve skin tone and texture, as well as deep penetration of natural antioxidants to provide antiaging benefits. The regimen evaluated in this study offers skin care practitioners and patients a well-tolerated alternative to commonly used stand-alone products, such as moisturizers, antioxidants, and retinoids.

In this study, dermatologist and expert grader assessments of facial skin indicated that treatment with 2 products from the investigational regimen (the revitalizing eye cream and the daily antioxidant facial serum) resulted in an immediate improvement in the appearance of fine lines, dryness, and tactile roughness. Although there were minor differences in the perception and evaluation of some efficacy parameters (Figures 1 and 2) by the dermatologist and expert grader, there was general agreement that use of the full 4-product regimen during a 3-week period resulted in modest improvements in the appearance of fine lines and dryness and, in the dermatologist's assessment, in facial roughness. While baseline skin hydration levels were high, immediate enhancement in the level of skin moisture following a single treatment with 2 products from the treatment regimen (the revitalizing eye cream and the daily antioxidant facial serum) was detectable by electrical conductance measurements. Significant enhancements in skin hydration were also found following 3 weeks of treatment with the full

4-product regimen. Subject self-assessment data indicated that the majority of subjects were satisfied with treatment results. In addition, this regimen was well tolerated, with no adverse events reported during the study period. A limitation of the current study is the lack of a placebo control. Future studies with a placebo may further refine the findings of this study.

### CONCLUSION

This physician-dispensed GLX-based antiaging facial treatment regimen improved objective appearance, was associated with satisfaction in the majority of those treated, and did not lead to any safety or tolerability issues in female subjects having mild to moderate photodamaged skin. This regimen may provide a new option for those seeking some control over the signs of facial aging.

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