# Polyhydroxy Acid (PHA) Skin Care Regimen Provides Comparable Anti-Aging Effects to an Alpha-Hydroxyacid (AHA) Regimen

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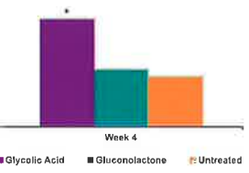
### Mean Sunburn Cell Count SBC/High Power Field




ant increase in SBCs compared to untreated, p<0.05

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all products on the face except cleansers and glamour products 3-5 days

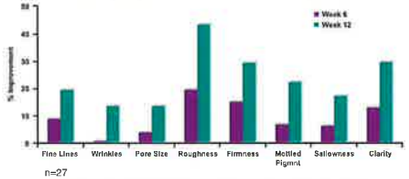
- **Regimen Usage:**
  - Each participant used a PHA-containing, wash-off cleanser twice daily followed by application of the daytime moisturizer with SPF 15 sunscreens during the day and the nighttime moisturizer in the evening.
  - Products were applied everyday for 12 weeks.
- **Clinical Evaluations (Baseline, Week 6, Week 12):**
  - **Performance parameters:** the left side of the face was evaluated by a trained visual grader using a 10-cm analog scale with 0.25cm increments (where 0 = none and 10 = severe) for the parameters: fine lines, coarse wrinkles, pore size, roughness, firmness, mottled pigmentation, sallowness (dullness), and clarity.
  - **Irritation parameters:** facial irritation was graded *objectively* for the parameters: erythema, edema and dryness, and *subjectively* for the parameters: burning, stinging, itching, tightness, and tingling, using a 0-3 scale.
  - **Pinch recoil:** measurements were taken of the left under eye area to assess skin elasticity by pinching the skin and recording time with a stopwatch (in seconds) to full recovery of the skin. The measurements were performed in triplicate, and the average score was reported. Pinch recoil is a recognized indicator of skin resiliency and firmness.[25]
  - **Silicone replicas:** negative impressions of skin topography on the left periocular (crow's feet) area were taken to assess changes in fine lines, coarse wrinkles and skin texture at baseline and after 12 weeks.
  - **Self-assessment:** questionnaires were completed by the panelists at each study visit.
- **Data Analysis:**
  - Mean scores of clinical grading parameters and pinch recoil measurements *within a treatment* were statistically analyzed compared to baseline scores using a paired t-test at the p<0.05 significance level.
  - Mean percent changes from baseline were calculated. Comparisons were made *between treatments* using ANOVA with pairwise comparisons using Fisher's LSD.
  - Silicone replicas were analyzed using image analysis by bioNet, Inc.

## Results

### CLINICAL GRADING: ANTI-AGING

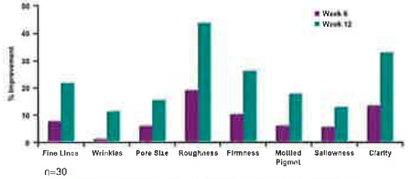
- The AHA and PHA regimens significantly improved the quality of photoaged skin at 6 and 12 weeks.
  - The AHA regimen scored significantly better than the PHA regimen for sallowness at 12 weeks. All other visually graded efficacy parameters were statistically equivalent.
- Skin resiliency was significantly improved at both 6 and 12 weeks for the AHA and PHA regimens.
  - The AHA treatment regimen improved skin elasticity more strongly than the PHA regimen at week 12, p<0.05. (13.5% vs. 10.2%)

### Anti-Aging Effects of AHA Regimen




n=27
**6 weeks:** all attributes, except wrinkles, significantly improved, p<0.05
**12 weeks:** all attributes significantly improved, p<0.05

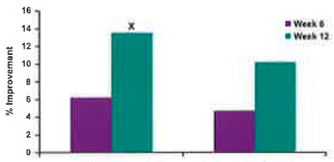
### Anti-Aging Effects of PHA Regimen




n=30
**6 weeks:** all attributes, except wrinkles, significantly improved, p<0.05
**12 weeks:** all attributes significantly improved, p<0.05

### Comparative Anti-Aging Effects of AHA and PHA Regimen Week 12 Comparison


### Pinch Recoil



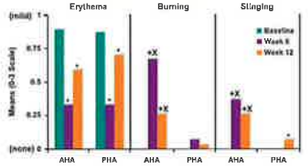

n=27 (AHA), n=30 (PHA)
Skin resiliency significantly improved at 6 weeks and 12 weeks with both the AHA and PHA regimens, p<0.05.
(X) The AHA treatment regimen improved skin elasticity more strongly than the PHA regimen at week 12, p<0.05, demonstrating improvements in skin elasticity of 13.5% and 10.2%, respectively.

- **Silicone Replicas (Week 12):**
  - **AHA regimen:** A significant improvement of wrinkles was measured by: Ra, Rz, spacing, shadows and number of wrinkles. There was an increase in the roughness parameter of fine lines corresponding to diminished coarse wrinkling. (As wrinkles diminish, fine lines increase in their place.)
  - **PHA regimen:** Significant improvement in the number of fine lines.

### CLINICAL GRADING: IRRITATION

- The AHA and PHA regimens were well tolerated.
- Minimal but statistically significant differences were observed for the parameters: erythema, burning and stinging. All other objective and subjective irritation parameters were not notable.

### Irritation Assessment

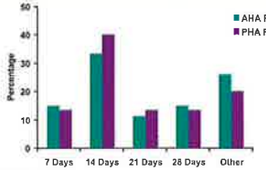



n=27 (AHA), n=30 (PHA)
(*) significant improvement from baseline, p<0.05: corresponds to erythema for AHA and PHA regimens, and stinging for PHA regimen
(+) significant worsening from baseline, p<0.05: corresponds to burning and stinging in the AHA treatment group
(X) burning, stinging significantly worse for AHA regimen compared to the PHA regimen, p<0.05

### CLINICAL GRADING: SELF-ASSESSMENT

- The AHA and PHA regimens were rated favorably for providing anti-aging effects.
- The PHA regimen was better tolerated at the 6 week timepoint based on self-assessed 'degree of sensitivity', p<0.05.

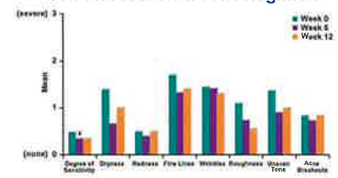
### Number of Days Until Skin Looked and Felt Younger




n=27 (AHA), n=30 (PHA)
**2 weeks:** 48.1% of AHA users and 53.3% of PHA users felt their skin improved.
**3 weeks:** 59.2% of AHA users and 66.6% of PHA users felt their skin improved.
**4 weeks:** 74% of AHA users and 80% of PHA users felt their skin improved.

### Self-Assessment: AHA Regimen


### Self-Assessment: PHA Regimen




n=30
All conditions improved or remained the same compared to baseline conditions.
(X) 'Degree of sensitivity' was statistically better for the PHA treatment group compared to the AHA treatment group, p<0.05.

## Conclusions

- The AHA regimen and PHA regimen provided significant anti-aging benefits to photoaged skin as measured by silicone replicas, clinical grading and pinch recoil for firmness.
- The anti-aging benefits of the AHA regimen and PHA regimen are equivalent with only a couple of statistically significant differences being noted:
  - Sallowness was more improved with AHA use at the 12-week time point only: 17.1% vs. 12.4%
  - Pinch recoil was more improved with AHA use at the 12-week time point only: 13.5% vs. 10.2%
- Use of the PHA regimen was better tolerated than the AHA regimen as evidenced by lower stinging and burning, as well as self-assessed 'degree of sensitivity'.

## Summary

There are many reasons to select polyhydroxy acids (PHAs), such as gluconolactone, for use in anti-aging skin care. They are suitable for use on all skin types, including sensitive skin, rosacea and atopic dermatitis.[15,18,19] Gluconolactone has been shown to provide anti-acne effects at higher concentrations[26], and it does not increase sun sensitivity[22-24]. PHA regimens have demonstrated compatibility with concomitant retinoid use[27], and offer gentle hydrating and light exfoliation effects[16,17,19]. PHAs are also anti-oxidants that have been shown to prevent the oxidative degradation of readily oxidized drugs, which may be in part due to their ability to chelate oxidation-promoting metals.[21,22] The present study demonstrates their equivalence in providing anti-aging benefits when compared to an AHA regimen, while being more gentle.

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**Title: A polyhydroxy acid (PHA) skin care regimen provides comparable anti-aging effects to an alpha-hydroxyacid (AHA) regimen**

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## Introduction

The alpha-hydroxyacids (AHAs) are one of few ingredient technologies that have advanced the science of cosmetic dermatology. Their benefits on skin are varied and impressive, having been documented in numerous clinical publications demonstrating both cosmetic and therapeutic effects.[1-8] Glycolic acid, the most commonly used AHA, has been shown to smooth skin, promote even skin tone, and enhance skin firmness, elasticity and luminosity/clarity. [6-8]

The beneficial effects of AHAs are mediated through several biological processes in skin. These include: 1) diminishing the bonding properties between corneocytes at the base of the stratum corneum leading to exfoliation – particularly of abnormally thick skin[1-3]; 2) normalization of epidermal structure and cell morphology as evidenced by improved differentiation, increased epidermal thickness, and more uniform melanin disbursement [9,10], which promotes improved skin clarity; and 3) at higher concentrations, AHAs have been shown to provide dermal effects including increased glycosaminoglycan (GAG) deposition (and a resultant skin plumping), collagen gene induction, and diminished solar elastosis as a result of the increased density of striated elastic fibers in place of globular, non-functioning fibers. [9-15] Taken together, all of these effects provide profound anti-aging and skin normalization effects.

Many new ingredients have been introduced as potential competitors to AHAs including copper peptides, vitamin C, and other imaginative hydroxyacid creations such as amino fruit acids, and glycocitrates. Little human-use clinical data is provided to support the use of these compounds, especially in comparison to the published findings with AHAs.

The polyhydroxy acids (PHAs) are a newer ingredient technology that extend the class of AHAs. Moreover, the PHAs have been studied in many human clinical studies to evaluate their cosmetic benefits. They provide similar anti-aging effects as AHAs, while being more gentle to skin, compatible with atopic and rosacea skin types, and enhance skin barrier efficiency.[16-20] These molecules also function as humectants/moisturizers and antioxidants as a result of their polyhydroxy structure.[21-22] **Importantly, gluconolactone and glucoheptonolactone (both PHAs) have been shown not to increase the potential for sun sensitivity as measured in the sunburn cell model (refer to Graph 1), which has been a source of concern with topical use of glycolic acid without sunscreen**.[23,24] While significant evidence exists to support the use of polyhydroxy acids (PHAs) for anti-aging skin care, a direct comparison of the anti-aging effects of AHAs and PHAs in skin care products has not been available.

## Objective

- The purpose of this poster is to summarize the results of a human clinical study demonstrating:
  - Relative equivalence in anti-aging activity between the tested AHA and PHA regimens
  - Enhanced mildness characteristics with the PHA regimen compared with the AHA regimen

## Method

- This was a twelve-week, controlled usage study to assess the comparative ability of an AHA-containing regimen and a PHA-containing regimen to reduce the signs of photoaging on the face. The study was conducted during the months October through January.

  - **Population:**
    - Caucasian females with mild to moderate periocular fine lines, periocular coarse wrinkles, and mottled hyperpigmentation on the face
    - Females, 31-58 years
    - AHA treatment group: n=27
    - PHA treatment group: n=30

  - **Conditioning Phase:**
    - Subjects discontinued all products on the face except cleansers and glamour products 3-5 days in advance of baseline.

  - **Test Products:**
    - Currently marketed products were selected for use in this study for claim support purposes. Products were provided in blinded packaging.

| | **AHA Regimen:** | **PHA Regimen:** |
|---|---|---|
| Daytime Moisturizer SPF 15 | 8% glycolic acid, pH: 3.8 | 4% gluconolactone, pH: 3.8 |
| Nighttime Moisturizer | 8% glycolic acid, pH: 3.7 | 10% gluconolactone, pH: 3.6 |
| **Total Daily Usage:** | **16% glycolic acid** | **14% gluconolactone** |

  - **Regimen usage:**
    - Each participant used a PHA-containing, wash-off cleanser twice daily followed by application of the daytime moisturizer with SPF 15 sunscreens during the day and the nighttime moisturizer in the evening.
    - Products were applied everyday for 12 weeks.

- **Clinical Evaluations (baseline, week 6, week 12):**
  - *Performance parameters:* the left side of the face was evaluated by a trained visual grader using a 10-cm analog scale with 0.25cm increments (where 0 = none and 10 = severe) for the parameters: fine lines, coarse wrinkles, pore size, roughness, firmness, mottled pigmentation, sallowness (dullness), and clarity.
  - *Irritation parameters:* facial irritation was graded *objectively* for the parameters: erythema, edema and dryness, and *subjectively* for the parameters: burning, stinging, itching, tightness, and tingling, using a 0-3 scale.
  - *Pinch recoil:* measurements were taken of the left under eye area to assess skin elasticity by pinching the skin and recording time with a stopwatch (in seconds) to full recovery of the skin. The measurements were performed in triplicate, and the average score was reported. Pinch recoil is a recognized indicator of skin resiliency and firmness.[25]
  - *Silicone replicas:* negative impressions of skin topography on the left periocular (crow's feet) area were taken to assess changes in fine lines, coarse wrinkles and skin texture at baseline and after 12 weeks.
  - *Self-assessment*: questionnaires were completed by the panelists at each study visit.

- **Data Analysis:**
  - Mean scores of clinical grading parameters and pinch recoil measurements *within a treatment* were statistically analyzed compared to baseline scores using a paired t-test at the $p<0.05$ significance level.
  - Mean percent changes from baseline were calculated. Comparisons were made *between treatments* using ANOVA with pairwise comparisons using Fisher's LSD.
  - Silicone replicas were analyzed using image analysis by bioNet, Inc.

**Results**

- **Clinical Grading – Anti-aging**

  - The AHA and PHA regimens significantly improved the quality of photoaged skin at 6 and 12 weeks.
    - The AHA regimen scored significantly better than the PHA regimen for sallowness at 12 weeks. All other visually graded efficacy parameters were statistically equivalent.
  - Skin resiliency was significantly improved at both 6 and 12 weeks for the AHA and PHA regimens.
    - The AHA treatment regimen improved skin elasticity more strongly than the PHA regimen at week 12, $p<0.05$. (13.5% vs. 10.2%)

Graph 2: Anti-Aging Effects of AHA Regimen (title)

(list conclusion bullets under the graphs)

- 6 weeks: all attributes, except wrinkles, significantly improved, $p<0.05$.
- 12 weeks: all attributes significantly improved, $p<0.05$

Graph 3: Anti-Aging Effects of PHA Regimen

- 6 weeks: all attributes, except wrinkles, significantly improved, $p<0.05$.
- 12 weeks: all attributes significantly improved, $p<0.05$

Graph 4: Comparative Anti-Aging Effects of AHA and PHA Regimen

- All attributes significantly improved from baseline, $p<0.05$
- (X) AHA regimen scored significantly better than the PHA regimen for sallowness. All other parameters were statistically equivalent.

Graph 5: Pinch Recoil

- Skin resiliency significantly improved at 6 weeks and 12 weeks with both the AHA and PHA regimens, $p<0.05$.
- The AHA treatment regimen improved skin elasticity more strongly than the PHA regimen at week 12, $p<0.05$, demonstrating improvements in skin elasticity of 13.5% and 10.2%, respectively.

**Silicone replicas (week 12):**

- **AHA regimen:** A significant improvement of wrinkles as measured by: Ra, Rz, spacing, shadows and number of wrinkles. There was an increase in the roughness parameter of fine lines corresponding to diminished coarse wrinkling. (As wrinkles diminish, fine lines increase in their place.)
- **PHA regimen:** Significant improvement in the number of fine lines.

**Clinical Grading – Irritation**

- The AHA and PHA regimens were well tolerated.
- Minimal but statistically significant differences were observed for the parameters: erythema, burning and stinging. All other objective and subjective irritation parameters were not notable.

Graph 6: Irritation Assessment

- (*) significant **improvement** from baseline, $p<0.05$: corresponds to erythema for AHA and PHA regimens, and stinging for PHA regimen
- (+) significant **worsening** from baseline, $p<0.05$: corresponds to burning and stinging in the AHA treatment group
- (X) burning, stinging **significantly worse** for AHA regimen compared to the PHA regimen, $p<0.05$

- **Clinical Grading – Self-Assessment**

    - The AHA and PHA regimens were rated favorably for providing anti-aging effects.
    - The PHA regimen was better tolerated at the 6 week timepoint based on self-assessed 'degree of sensitivity', $p<0.05$.

Graph 7: Number of Days until Skin Looked and Felt Younger

- 2 weeks: 48.1% of AHA users and 53.3% of PHA users felt their skin improved
- 3 weeks: 59.2% of AHA users and 66.6% of PHA users felt their skin improved
- 4 weeks: 74% of AHA users and 80% of PHA users felt their skin improved

Graph 8: Self-Assessment – AHA Regimen

- All conditions improved compared to baseline conditions, except 'degree of sensitivity'.
- 'Degree of sensitivity' was statistically worse for the AHA treatment group compared to the PHA treatment group, $p<0.05$.

Graph 9: Self-Assessment – PHA Regimen

- All conditions improved or remained the same compared to baseline conditions.
- 'Degree of sensitivity' was statistically better for the PHA treatment group compared to the AHA treatment group, $p<0.05$.

**Conclusions**

- The AHA regimen and PHA regimen provided significant anti-aging benefits to photoaged skin as measured by silicone replicas, clinical grading and pinch recoil for firmness.
- The anti-aging benefits of the AHA regimen and PHA regimen are equivalent with only a couple of statistically significant differences being noted:
    - Sallowness was more improved with AHA use at the 12-week time point only: 17.1% vs. 12.4%
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- Use of the PHA regimen was better tolerated than the AHA regimen as evidenced by lower stinging and burning, as well as self-assessed 'degree of sensitivity'.

**Summary**

There are many reasons to select polyhydroxy acids (PHAs), such as gluconolactone, for use in anti-aging skin care. They are suitable for use on all skin types, including sensitive skin, rosacea and atopic dermatitis.[16,18,19] Gluconolactone has been shown to provide anti-acne effects at higher concentrations[26], and it does not increase sun sensitivity[23,24]. PHA regimens have demonstrated compatibility with concomitant retinoid use[23], and offer gentle hydrating and light exfoliation effects[16,17,19]. PHAs are also anti-oxidants that have been shown to prevent the oxidative degradation of readily oxidized drugs, which may be

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**References**


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This study was conducted by Stephens & Associates, Carrollton, TX by Dr. Monya Sigler with Board Certified Dermatologist, James H. Herndon, Jr., M.D.

Footnote: American Academy of Dermatology Poster Exhibit: San Francisco, CA; March 22-24, 2003.