Evaluation of Inherent Differences in Ethnic Skin Types and Response to Topical Polyhydroxy Acid (PHA) Use

Pearl Grimes, M.D.[1], Brenda L. Edison[2], Barbara A. Green, R.Ph[2]., Richard H. Wildnauer, Ph.D.[2]

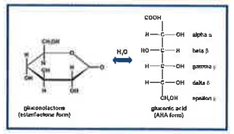
[1]Vitiligo and Pigmentation Institute of Southern California, Los Angeles, CA, USA and [2]NeoStrata Company, Inc., Princeton, NJ, USA.

Introduction

There is a general perception that skin from various ethnic groups possesses different properties which may affect barrier function, responsiveness to topical agents, sebum production, moisturization requirements and chemical sensitivities, to name a few. Although there is a lack of scientific data to support the hypothesis that skin of different ethnic origins is somehow physiologically different, many physicians and consumers believe a difference exists. This is at least in part due to marketing efforts for products designed to meet the perceived needs of specific ethnic groups. While there may be inherent differences between skin of varying ethnic types beyond the level of pigmentation, only a few studies have been conducted to make direct comparisons.

Additionally, many studies that have investigated the response of photoaging attributes to products have been limited to lighter skin types as defined by Fitzpatrick types I, II, or III. This holds true for previous studies conducted with the polyhydroxy acid (PHA), gluconolactone. Gluconolactone is the lactone form of gluconic acid that is found naturally occurring in the skin[1].

Studies with gluconolactone have demonstrated efficacy in reducing the signs of photoaging, as well as demonstrating compatibility with sensitive skin as defined by self-assessment[2] and by atopic and rosacea skin conditions[3]. Gluconolactone has also been shown to provide a conditioning effect to skin barrier function as evidenced by reduced damage from a surfactant challenge[4]. These studies utilized lighter skin types in their assessments, and a direct comparison of the response to some of these parameters by darker skin types is lacking.



The present study was conducted to gain some understanding of the inherent differences between African-American, Hispanic/Asian, and Caucasian skin as well as their response to a PHA containing regimen.

Objective

The purpose of this study was twofold:

1. To assess if differences exist among measured skin surface parameters of three different ethnic groups (i.e. African-American, Hispanic/Asian, and Caucasian); and
2. To determine the response of these ethnic groups to a polyhydroxy acid containing regimen.

Specifically, these objectives were assessed through visual evaluation, self assessment, and/or instrumental measurements.

Study Participants

- Healthy females, 35-65 years of age with moderate photodamage
  - African-American, n=18
  - Caucasian, n=19
  - Hispanic/Asian, n=15 (9 Hispanic, 6 Asian)

Method

- **Conditioning Phase:** Discontinue use of any topical products other than normal cleansers or non-medicated makeup, to the face and forearms for 2 days prior to study initiation
- Participants must not have used topical **AHAs or retinoids** for 3 months prior to study initiation, or systemic retinoids for 12 months prior to study initiation
- Dermatologist visual assessments utilized a **5 point scale** (none, mild, moderate, marked, severe)

Assessment of Inherent Differences

Assessments conducted at baseline visit using Courage-Khazaka Instrumentation

- Face
  - **Dermatologist visual assessment of photodamage** including: roughness, uneven skin tone, hyperpigmentation, laxity, fine lines, deep wrinkles, overall photodamage severity
  - **Dermatologist visual assessment of oiliness, objective irritation** (erythema, peeling/dryness, inflammation, overall irritation), and inquiry of **subjective irritation** (burning/stinging and itching)
  - **Sebumeter SM810** - measurement of amount of sebum ($\mu g/cm^2$) assessed on midline of forehead
  - **Skin pH Meter PH900** - measurement of skin pH assessed above left eyebrow
- Forearm
  - **Dermatologist visual assessment of irritation** including: erythema and peeling/dryness
  - **Corneometer CM 825** - measurement of skin moisture (arbitrary units)
  - **Tewameter TM 210** - measurement of barrier function by means of transepidermal water loss (TEWL) (g/hm^2)
  - **Chemical Challenge** - a subgroup of subjects participated in an optional 6 hour 5% sodium lauryl sulfate **(SLS) occlusive patch challenge** with above measurements at 0, 24, and 48 hours post patch removal to determine resistance of skin to chemical insult (assessment of barrier integrity)

Assessment of Response to PHA Containing Regimen

- **Study Duration:** 12 weeks with visits at baseline, 2, 6, and 12 weeks
- Subject blinded, comparison to baseline
- **Dermatologist visual assessment of photodamage** as above
- **Dermatologist visual assessment of oiliness, objective irritation**, and inquiry of **subjective irritation** as above
- **Self-assessment** questionnaires

Test Materials

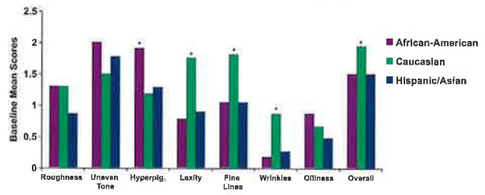
Twice daily application of cleanser and appropriate moisturizer to face

- Foaming Cleansing Gel: < 1% gluconolactone, pH 4.0
- Daytime Lotion, SPF 15: 4% gluconolactone, pH 3.7
- Nighttime Crème: 8% gluconolactone, pH 3.7

Results

Inherent Ethnic Differences at Baseline

Dermatologist Assessment – Photoaging Parameters



*Significantly more severe condition ($p \leq 0.05$) compared to the other ethnicities

- Uneven skin tone and hyperpigmentation are more severe in darker skin
- Fine Lines, wrinkles, laxity and overall photodamage are more severe in lighter skin

Dermatologist Assessment – Irritation Parameters

- Erythema on the face was significantly higher in the Caucasian group compared to the other ethnicities
- There were no significant differences in inflammation, overall irritation, or subjective irritation (burning/stinging, itching)

Instrumental Assessments

Assessment	African-American n=18	Caucasian n=19	Hispanic/Asian n=15
Sebumeter (face)	158.9	164.0	150.5
pH meter (face)	5.7	6.0	5.4
Erythema (arms)	0	0	0
Corneometer (arms)	31.6	32.8	31.9
TEWL (arms)	7.9	7.8	10.6

- No significant differences between the ethnicities for the parameters listed

TEWL and SLS Challenge

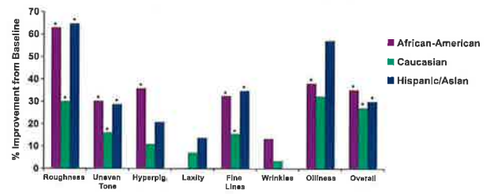
Assessment	African-American n=3	Caucasian n=5	Hispanic/Asian n=6
Baseline TEWL – SLS Challenge subset	9.1	8.7	9.7
After SLS Challenge time=0	21.9	32.3	20.4
24 hours after SLS Challenge	13.6	14.0	16.5
48 hours after SLS Challenge	12.9	12.9	16.8

Statistical analysis was not conducted on the SLS Challenge data due to the reduced population sizes

- Caucasian has an increase in water loss immediately after patch removal and recovers similarly compared to the other ethnicities after 24 hours

Response to PHA Containing Regimen After Product Use

Dermatologist Assessment – Photoaging Parameters



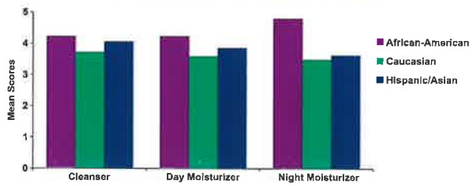
*Significant improvement ($p \leq 0.05$) compared to baseline

Irritation Parameters – Objective and Subjective Mean Score at Endpoint

Assessment-Mean Score	African-American	Caucasian	Hispanic/Asian
Erythema	0	0.7*	0.4
Dryness	0.5	0.5*	0.4*
Inflammation	0	0	0
Burning/Stinging	0	0	0
Itching	0	0	0
Overall Irritation	0	0	0

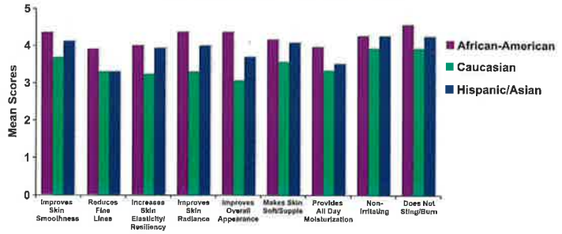
- Significantly less erythema or dryness compared to baseline ($p \leq 0.05$)

Self Assessment – Product Compatibility



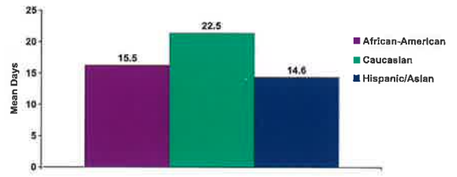
Scoring Scale: 5=excellent, 4=very good, 3=good, 2=fair, 1=poor

Self Assessment – Product Effects



- All ethnicities rated all of the parameters from good to excellent

Self Assessment – Days to Younger Looking Skin



Conclusions

Inherent Ethnic Differences

- Differences exist among the ethnicities in the following areas:
  - Uneven skin tone is more apparent in darker skin types, perhaps due to light reflectance, optical properties, and post inflammatory hyperpigmentation of darker skin tones
  - Textural aging parameters such as fine lines, wrinkles, and laxity are more apparent in lighter skin most likely as a direct result of increased sun damage due to decreased inherent melanin protection
  - Chemical (SLS) Challenge data may indicate that Caucasian skin is initially more sensitive to chemical insult
- When using objective instrumentation, no differences were observed between the ethnicities for sebum production, or pH measured on the face, or moisture content (corneometry), or barrier function (TEWL) measured on the arm.
- No differences were seen upon visual assessment on the face for inflammation, overall irritation, or subjective irritation (burning/stinging, itching), or on the arm for objective irritation.

Response to PHA Containing Regimen

- All three ethnicities exhibited significant improvements in photoaging parameters after 12 weeks of use with the gluconolactone containing regimen.
- The PHA containing regimen was well tolerated by all three populations as evidenced by low objective irritation and no subjective irritation after 12 weeks of use. This is further supported by subject self assessment.
- African-American and Hispanic/Asian groups saw greater improvements in dermatologist assessment and self assessment for most parameters.
  - The lower severity of the parameters at baseline for these groups may provide a greater chance for improvement, especially in the textural aging parameters such as fine lines.
  - Alternatively, for more surface changes such as uneven skin tone and hyperpigmentation, a more severe condition may lend itself to showing greater improvements.

References

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4. Berardesca E, Distante F, Vignoli GP, Oresajo C, Green B: Alpha hydroxyacids modulate stratum corneum barrier function. *British J Dermatol* 1997;137:934-938.