

# Evaluation of Mineral Cosmetics

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This single-center study was designed to evaluate the efficacy, coverage, durability, and comparability of 2 mineral-based facial cosmetic lines: DYG and Jane Iredale.

A cosmetic artist applied makeup from one of the cosmetic lines to each half of the faces of 20 women who were blinded as to which product was used. The volunteers were then asked to go about their usual daily routines. Each face was photographed before application, immediately after application, and 7 hours after application. Each subject evaluated the makeup on both halves of her own face using a written questionnaire that assessed comfort, duration, and general satisfaction. Four evaluators who were blinded as to the type of cosmetic applied to each side viewed photographs of the subjects and used a 10-point scale to grade the durability and coverage of the cosmetic used.

The DYG product line was demonstrated to be comparable with, and in many cases better than, the Jane Iredale line in terms of duration of application and patient comfort and satisfaction. Enhanced efficacy was up to 20% higher with the DYG product line over the Jane Iredale line ( $P=.25$ ). Both mineral-based cosmetic lines were well tolerated.

The application of topical agents to enhance beauty has been practiced over the centuries. The Egyptians are credited with the origination of cosmetics (ca 4000 BC) with their utilization of mesdemet, a dark grey ore of lead. They also applied green malachite (green ore of copper) for color and definition.<sup>1</sup>

Over the years, many new emerging minerals and botanicals have been used in cosmetics. Some, such as lead oxide used in surma (also known as kohl) to line the eyelids, proved to be toxic and were banned.<sup>2</sup> Other agents were found to have beneficial effects on the skin and are used in makeup today. Therefore, which minerals are beneficial, and which benefits do they offer?

Mineral makeup was first introduced to the public in the 1970s and, over the past decade, has surged forward as a leader in the cosmetics world. Its popularity is due

to its claim to rejuvenate and protect the underlying skin while providing coverage and color to hide imperfections and accentuate positive features. Synthetic dyes, preservatives, perfumes, and fillers are avoided in the composition of mineral makeup, rendering it hypoallergenic. The inert nature of minerals inhibits bacterial growth.

Minerals are milled, oftentimes triple-milled, into a fine powder that blends well into skin without clogging pores. Minerals are also used as a camouflage for contour and pigment defects and as a transitional application for postsurgical erythema.<sup>3</sup> Mineral-based cosmetics are sometimes called *cosmeceuticals*.<sup>4</sup>

Commonly used ingredients in mineral cosmetics are listed in Table 1. Many different lines of mineral makeup are now available, with various combinations of ingredients. This study evaluates 2 of these mineral-based cosmetic lines.

## METHODS

Twenty subjects participated in a daylong study that consisted of preapplication photography using a Canfield Scientific Fuji S2 Pro digital camera and head restraint (Figure, A). Each subject thoroughly cleaned her face with

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TABLE 1

## Common Ingredients of Mineral Cosmetics

Ingredient	Function
<b>Vitamins</b>	
Vitamin E (alpha-tocopherol)	Lipid-soluble antioxidant used to protect cellular membranes from lipid peroxidation by scavenging free radicals and lipid peroxy radicals <sup>5</sup>
Vitamin C (L-ascorbic acid)	Water-soluble antioxidant and cofactor for collagen synthesis; helps regenerate the oxidized forms of alpha-tocopherol <sup>6-7</sup>
Vitamin A (retinol and retinyl palmitate)	Retinoid function in maintaining epidermal differentiation and growth, thereby increasing epidermal thickness <sup>8</sup>
Nicotinamide (niacinamide)	B vitamin and derivative of niacin; anti-inflammatory and anti-acne vulgaris actions <sup>9</sup>
Coenzyme Q10 (ubiquinone)	An endogenous cellular antioxidant and mitochondrial electron transfer protein that exerts an antioxidant effect, thereby counteracting UV damage <sup>10</sup>
Tea extracts (eg, green tea, black tea, and coloring tea)	Contain polyphenolic compounds that have significant antioxidant and anti-inflammatory activity <sup>11</sup>
<b>Botanicals</b>	
Flavones (eg, rutin, quercetin [apples and blueberries], hesperidin, diosmin [lemons and oranges]) <sup>12</sup>	Polyphenolic structure that confers antioxidant, UV protectant, and metal chelation properties
Carotenoids (eg, astaxanthin, lutein, lycopene)	Chemically related to vitamin A, therefore, a natural retinoid; commonly found in tomatoes
Xanthones (eg, mangiferin [mango plant], mangostin [bilberry plant])	Water-insoluble antioxidant
Polyphenols (eg, rosmarinic acid [rosemary], chlorogenic acid [blueberry leaf], ellagic acid [pomegranate fruit], oleuropein [olive leaf], tea) <sup>12</sup>	Oxygen and nitrogen free radical scavenger
<b>Minerals</b>	
Titanium dioxide, zinc dioxide	Have UV protectant effects; brighten and intensify color; give whiteness and opacity to cosmetics <sup>4</sup>
Mica	Adds luster and pearlescence; is resistant to UV light, heat, and chemical attack; adheres to the skin
Calcium carbonate	Absorbs moisture
Iron oxide, chromium oxide, ground lapis, manganese violet, gold	Adds color to cosmetics



Subject before (A), immediately after (B), and 7 hours after (C) application of mineral-based cosmetics.

a gentle facial cleanser. Equal amounts of the 2 cosmetic products, as determined visually by the cosmetic artist, were then applied to each side of the face. Care was taken to ensure that all applications were done by the same cosmetic artist, using comparable product colors. All subjects were randomized as to which side of the face received which cosmetic. All 4 evaluators were blinded as to the cosmetic used. Photographs of each subject's face were taken immediately following application (Figure, B).

Subjects were then asked to go about their daily routines and not retouch their cosmetics or blot or wash their faces. Subjects were asked to return 7 hours later for more photographs (Figure, C). At that time, they were also given a satisfaction questionnaire to complete that asked them to identify which side of the face felt more comfortable, was itchier, or seemed more irritated; which side of the face had makeup that lasted longer; and which side of the face had makeup that better covered pigmentation, blotches, acne scars, and other imperfections.

Photographs of each subject before application, immediately after application, and 7 hours after application were then graded by 4 evaluators using a 10-point scale, with 10 signifying perfect coverage and appearance and 1 signifying the least coverage and worst appearance. Grading criteria of the makeup included appearance, duration, and coverage. The subjects were asked to evaluate 3 individual end points: (1) the number of hours of perceived satisfactory cosmetic coverage; (2) coverage rating (using a scale of 1–4, where 1=poor coverage and 4=ideal coverage); and (3) satisfaction (using a scale of 1–10, where 1=very unsatisfied and 10=very satisfied).

## RESULTS

Both cosmetics were visually inapparent 7 hours after application. (Figure, C). However, Jane Iredale makeup was somewhat more persistent in both coverage and duration (the number of hours of satisfactory coverage). DYG makeup was found to be very similar in duration and coverage to Jane Iredale makeup, outperforming it in 3 subjects for coverage and in 2 subjects for duration. The subject questionnaires yielded equal satisfaction with both products and generally uniform scores (Tables 2 and 3).

## DISCUSSION

Mineral makeup has increased in popularity over the past decade. The appeal of mineral makeup is largely due to the commitment of its makers to create a cosmetic that not only provides coverage and color to enhance features but is composed of natural ingredients to help rejuvenate and protect the skin from UV light and environmental pollutants.

Because of the variety of mineral cosmetics available, it is hard for consumers to know which ones to choose. The key is finding a product that provides effective coverage, good duration of action, and an array of colors to match a variety of skin tones. Consumers should also be familiar with the different botanicals and minerals incorporated into the cosmetics and their pharmacologic actions.

The DYG line of cosmetics uses triple-milled minerals that are noncomedogenic along with botanical antioxidants to help rejuvenate and restore the skin while highlighting and defining facial features. The

TABLE 2

### Durability (Staying Power) of Mineral Cosmetics Applied to Each Half of the Face for 7 Hours\*†

Subject	DYG					JI					Difference (DYG-JI)‡				
	B	LS	ES	PP	O	B	LS	ES	PP	O	B	LS	ES	PP	O
1	8	6	9	8	8	7	5	8	8	8	1	1	1	0	0
2	9	5	9	9	8	9	6	10	9	9	0	-1	-1	0	-1
3	8	7	8	8	8	9	7	9	8	9	-1	0	-1	0	-1
4	7	5	9	6	6	7	5	9	6	7	0	0	0	0	-1
5	9	7	8	9	8	9	6	8	8	8	0	1	0	1	0
6	8	7	8	7	8	8	6	7	7	7	0	1	1	0	1
7	9	7	7	7	7	8	7	9	7	8	1	0	-2	0	-1
8	8	6	7	7	7	8	5	8	8	8	0	1	-1	-1	-1
9	8	5	7	8	7	8	5	7	8	8	0	0	0	0	-1
10	8	7	8	8	8	8	7	8	8	8	0	0	0	0	0
11	9	5	8	9	8	7	6	7	7	7	2	-1	1	2	1
12	8	7	9	7	8	8	5	8	5	6	0	2	1	2	2
13	8	6	9	7	7	7	5	8	8	7	1	1	1	-1	0
14	8	5	8	8	9	8	6	9	8	8	0	-1	-1	0	1
15	7	6	9	7	7	8	5	9	7	8	-1	1	0	0	-1
16	0	1	2	2	2	0	0	0	0	0	0	1	2	2	2
17	8	5	8	7	7	9	7	8	7	8	-1	-2	0	0	-1
18	8	7	8	8	8	8	7	9	7	7	0	0	-1	1	1
19	8	6	7	7	7	7	5	9	6	6	1	1	-2	1	1
20	7	5	7	6	6	8	6	7	6	7	-1	-1	0	0	-1
Mean	8	6	8	7	7	8	6	8	7	7	NA	NA	NA	NA	NA
SD	1.899	1.41	1.552	1.517	1.436	1.905	1.538	2.033	1.889	1.881	NA	NA	NA	NA	NA
Mean percentage	25	45	30	30	20	20	25	35	10	45	5	20	-5	20	-25
P	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.4924	.424	1.00	.289	.267

\*Durability rating is based on a scale of 1 to 10, where 1=no apparent makeup coverage and 10=perfect makeup coverage.

†JI indicates Jane Iredale; B, blush; LS, lipstick; ES, eye shadow; PP, pressed powder; O, overall; NA, not applicable.

‡Significant percentage difference in favor of DYG lipstick (20%) and pressed powder (20%) was observed.

TABLE 3

Coverage (Ability to Cover Imperfections) of Mineral Cosmetics Applied to Each Half of the Face for 7 Hours\*†

Subject	DYG					JI					Difference (DYG-JI)‡				
	B	LS	ES	PP	O	B	LS	ES	PP	O	B	LS	ES	PP	O
1	9	8	9	8	8	0	0	0	0	0	9	8	9	8	8
2	8	8	8	8	8	0	0	0	0	0	8	8	8	8	8
3	7	6	7	8	8	0	0	0	0	0	7	6	7	8	8
4	8	8	8	8	8	0	0	0	0	0	8	8	8	8	8
5	8	8	8	7	8	0	0	0	0	0	8	8	8	7	8
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	8	8	8	8	8	0	0	0	0	0	8	8	8	8	8
8	7	7	8	8	8	0	0	0	0	0	7	7	8	8	8
9	8	7	9	8	8	0	0	0	0	0	8	7	9	8	8
10	8	8	9	8	8	0	0	0	0	0	8	8	9	8	8
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean	4	3	4	4	4	0	0	0	0	0	NA	NA	NA	NA	NA
SD	4.05	3.89	4.22	4.03	4.08	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA
Mean percentage	15	35	25	15	15	20	45	30	35	25	-5	-10	-5	-20	-10
P	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.00	.804	.55	.11	.29

\*Coverage rating is based on a scale of 1 to 10, where 1=no apparent makeup coverage and 10=perfect makeup coverage.

†JI indicates Jane Iredale, B, blush; LS, lipstick; ES, eye shadow; PP, pressed powder; O, overall; NA, not applicable.

‡No significant percentage difference between DYG and JI cosmetics was observed.

duration, coverage, and feel of this cosmetic line have been demonstrated to be similar to the duration, coverage, and feel of the established Jane Iredale line. Future studies will evaluate the antiaging effects of a variety of mineral cosmetics.

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