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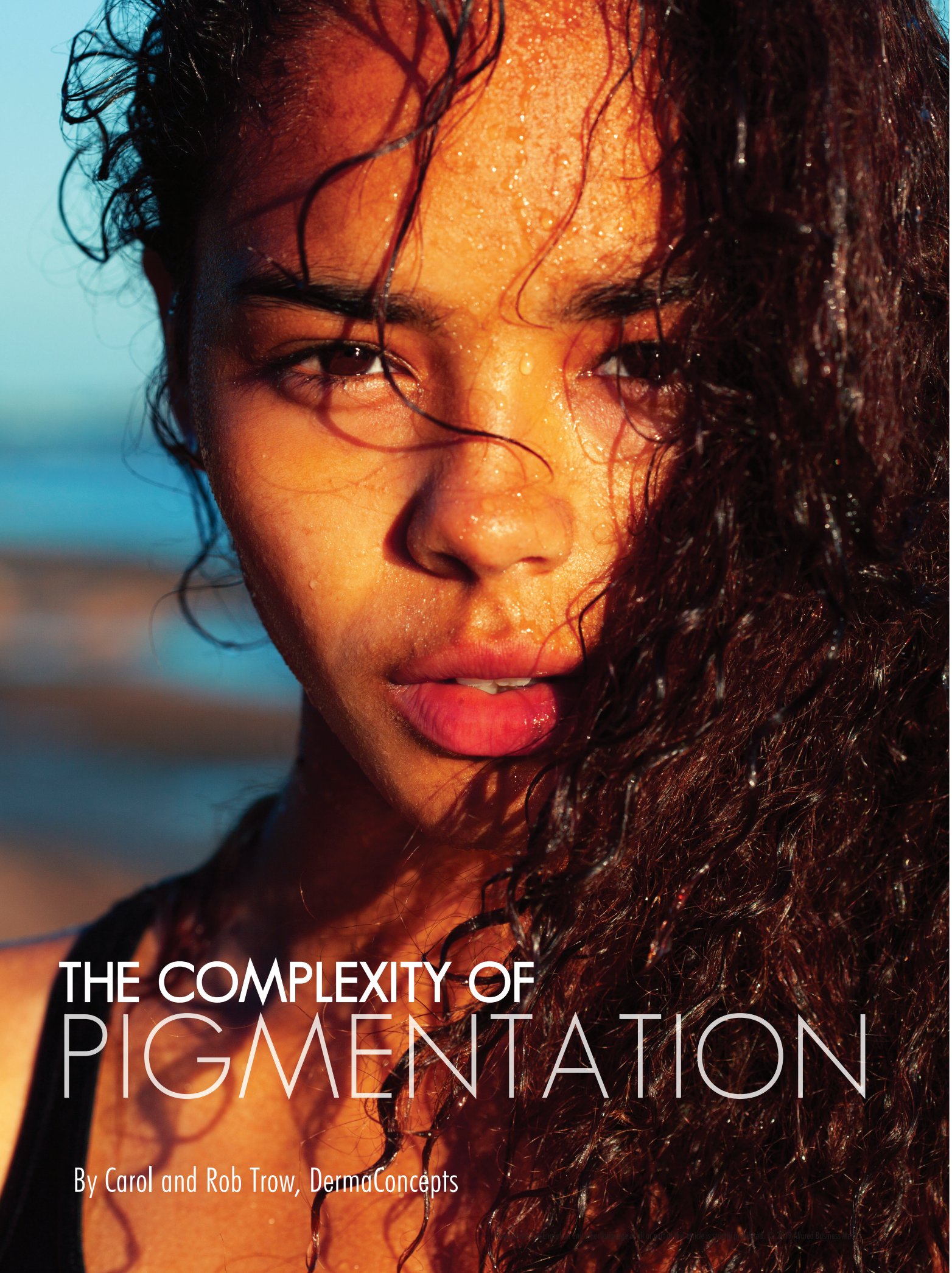
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THE COMPLEXITY OF PIGMENTATION

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For over a century, humans have been obsessed with skin color. With an ever changing population and multicultural diversity, skin care professionals are facing a number of challenges on how best to address pigmentation. This article will serve as a primer on pigmentation, its historical roots, cultural norms, the science behind changes in skin color, early treatments and today's cornucopia of ingredients that may or may not be efficacious.

One of the most difficult to treat skin conditions is hyperpigmentation. In spite of the number of treatment options, including prescription and cosmetic topical creams, nothing has provided the perfect solution in pigment preventers and measurable improvement.

Whether pigmentation results from sun damage, acne, inflammation, birth control, pregnancy, hormones, prescription drugs or injury, it is caused by an irregular increase in melanin.

THE SCIENCE OF PIGMENTATION

Melanin is a dark brown to black pigment that is produced by cells known as melanocytes in the skin. This process is called melanogenesis. To treat and ameliorate this process, we need to disrupt the production of melanin. The keratinocytes regulate the melanocyte process through the release of chemicals that produce and drive melanin to the surface, and the activation of tyrosinase. Treating pigmentation involves disrupting this cycle.

MELANOGENESIS

The process of melanin production is known as melanogenesis—a complicated pathway as briefly described below wherein the melanocyte within the melanosome produces melanin.

1. Activation. Skin is exposed to sun or other stressors both internal and external such as medical treatments and hormones, which interact with the melanocyte.

2. Oxidation. Tyrosine is oxidized by the enzyme tyrosinase, to become L-DOPA.

3. Conversion. Tyrosine along with L-DOPA and dopaquinone create the building blocks for melanin.

4. Formation. Melanin is formed and deposited in keratinocytes in the dermal or epidermal layer, manifesting as pigmentation.

PIGMENTATION IN DARKER SKIN TONES

A myriad of medical treatments, acne and other procedures produce resistant pigmentation known as post inflammatory hyperpigmentation (PIH). This type of pigmentation is common in ethnic skin.

One of the most resistant and difficult skin conditions that plague everyone but especially skin of color is melasma, sometimes called pregnancy mask.

To treat these conditions, it is worthwhile to review the science behind what causes them. Remember, it takes time, and skin professionals need to set realistic expectations on outcomes. It can take a year or more of constant attention to achieve extraordinary results. Using the scientific basis of this condition can serve to provide an excellent working model for the treatment of most pigmentation skin issues.

As always, a first step is to review clients' medical records to assess if there may be an underlying cause to the production of pigmentation. There are other factors that also come into play such as mast cells plus prostaglandins. The pituitary gland releases hormones as well.

HISTORY

It is believed that all humans share a common ancestor going back over 200,000 years.¹ As evolution evolved, many cultures favored lighter skin.² Pale skin was a sign of social status, not having to perform manual labor outside. Even so, our forebearers went to extremes to whiten even their pale skin by applying lead based cosmetics as well as arsenic to whiten skin tone. Little was known about the hazardous health effects resulting in cancers and even death. Skin tone was also attributed to slavery in North America, with lighter skinned slaves being considered smarter, more cooperative and more attractive.³ The lighter your skin, the more likely you would be treated preferentially (an oxymoron) by slave owners and even one's peers.

During the 20th century, French designer Coco Chanel advocated that tanned skin is fashionable, more

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attractive and healthier for you. She also showed models smoking while sunbathing.⁴ In North America, it was cool to use baby oil mixed with iodine along with sun reflectors to get a great tan. With the advent of skin science, it became apparent that working on getting a great tan is a dangerous pursuit.

Skin color remains an unhealthy obsession, even today. Skin lightening products today represent over \$50 billion in sales worldwide.⁵ They are in great demand all over the world, with Asia, Latin America, India and Africa leading the way as cultural bias remains influenced by skin color.

EARLY TREATMENT

Early treatment of pigmentation also included the use of borax, sulfur, iodine, potassium and sodium hydroxide.⁶ Shortly thereafter, mercury and hypochlorite, salicylic and ascorbic acid became a preferred remedy for treating pigmentation.⁷ Not only did these treatments not

work, they created serious health risks and resulted in rebound pigmentation that left skin darker and even more resistant to treatment.

Hydroquinone gained favor in the early 20th century when it was noticed that workers in tanning and rubber factories experienced depigmentation of their skin if exposed to the chemicals used in their factories.⁸ In the period between 1961 and 1965, several studies were done that demonstrated that hydroquinone has a positive effect on alleviating hyperpigmentation.⁹ Alas, rebound pigmentation remained a problem. Albert Kligman was responsible for a quantum leap in the use of hydroquinone when he devised a cocktail of 0.1% tretinoin (vitamin A), 5% hydroquinone and 0.1% dexamethasone.¹⁰ This formulation has a material positive effect in ameliorating the appearance of pigmented skin. He found eliminating any one of the three ingredients made the effect nonexistent. While many in the skin care field rely on hydroquinone

as a treatment of choice, it has been banned in Europe and other regions, and the U.S. Food and Drug Administration (FDA) continues to study its safety. Research has also found that in higher percentages such as 5%, it can be an irritant, induce ochronosis, especially in skin of color, and might cause permanent depigmentation.¹¹⁻¹² It has also been proven that hydroquinone has caused cancer in rats and bone marrow toxicity in humans. To be clear, there is no definitive proof on the dangers of hydroquinone, and research continues to this day.

TREATING PIGMENTATION

The question is, if hydroquinone poses potential risks, especially in ethnic skin, what options are there? All one has to do is open any professional magazine or watch television to hear about a myriad of miracle ingredients that will address improving pigmentation. Oh, don't we all wish it was true. There is hope, although results take time and following a professionally recommended regime is necessary.

Sunscreens! Sun exposure coupled with the failure to use and reapply sunscreens lead to an increase in the production of melanin. As with everything, the constant, disciplined use of sunscreens, applied every 90 minutes, goes a long way to improving skin appearance when used before and after any treatment regime.¹³ Start with a broad spectrum sunscreen that has physical blockers and a brigade of antioxidants.

Topical ingredients. Commonly used topicals on the market include zinc sulfate, arbutin, licorice, niacinamide, azelaic acid, kojic acid, ascorbic acid, green tea, retinoids and steroids.



Reapplying sunscreen is key to improving skin appearance before and after treatments.

Of particular benefit is a tyrosinate inhibitor such as undecylenoyl phenylalanin. *Alpinia katsumadai hayata*, arbutin, *Geranium robertianum* extract, hydrolyzed *Prunus domestica*, niacinamide (B3), retinoids (vitamin A) and vitamin C (in specialized formulations that do not turn brown or amber) can serve to foster the chemical communication pathway and help improve pigmentation.

Devices. Add skin needling, specialized lasers (most notably Q switched Nd:YAG.),¹⁴ IPL to degrade melanin granules and LED to help restore cellular homeostasis.

Recent research. New to the literature are brightening formulations that use SMA-432, a prostaglandin, E2 inhibitor.¹⁵

Peels. There are a series of studies all involving a small sample size that claim superficial peels are effective in managing skin pigmentation in ethnic skin. These include glycolic, salicylic and TCA peels.^{4, 15, 16}

Supplements. Do not rule out the careful effective use of supplements like vitamin A and omega 3.

A COMPLEX PROCESS

While the process of melanogenesis is only briefly described here, the myriad of factors that produce melanin and contribute to skin pigmentation are many and complex. The transfer of melanin to the keratinocytes takes place over time, and only a multi-pronged treatment plan has any chance of working.

Do not expect overnight

results. If products claim to offer instant results, they are way off base. If something sounds too good to be true, then you can be sure it is not true.

You need to educate your patients or clients and provide a treatment plan as mentioned previously to reduce exposure to UV rays, inhibit melanogenesis and inhibit melanin production and melanosome transfer. So, how do you accomplish this?

The treatment approach provided here is only one way to approach pigmentation, among many. Use this as a guide to evaluate the many options that exist, but beware of fraudulent promises. For the purposes of this article, the authors have greatly truncated the process of melanogenesis, and the detailed steps in the chemical formation of pigmentation as well as the scientific basis for improving the appearance of pigmented skin.

To attack pigmentation with sustainable results, you need to go into a battle with a multipronged approach, maintained over time. Professional treatment programs and home-care routines need to include a multitude of ingredients that block many melanogenesis communication pathways, and they need to be diligently followed for what may be several months or up to a year before results are seen. This will yield sustainable results. Make sure to do your own research. ✂

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