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# Antioxidants

MUST-HAVES FOR FALL

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**O**UR CLIENTELE'S SKIN HAS experienced an active season and as fall approaches, we must restore it from the damage it encountered during summertime activities. Throughout the warmer months, we participate in more outdoor activities and tend to spend extended periods of time in the sun. Daily use of broad-spectrum sun protection is critical, but no sunscreen can protect us from 100 percent of the ultraviolet rays or their damaging effects. Enhancing the protection of our patients' skin requires the incorporation of antioxidants into their daily regimen.

## Necessary balance

Human skin is an intricate ecosystem that requires a multitude of actions and reactions to maintain homeostasis (balance). We hear talk of free radicals and the damage they cause to our skin. Contrary to popular belief, some free radicals are actually necessary components of cellular metabolism and are safely contained by our skin's natural antioxidant defense system.

The real challenge begins when we introduce outside forces that disrupt this balance. The skin's number one enemy is clearly ultraviolet radiation. Ultraviolet rays are particularly damaging to the skin as they have been shown to not only increase free radical levels, but also deplete the skin's endogenous (internal) antioxidant defense system.

## Ultraviolet rays

The shortest rays are UVC (200 to 280 nm). At this time, our ozone layer prevents these rays from reaching the Earth's surface. Midrange UVB (280 to 320 nm) and long-wave UVA (320 to 400 nm) are the rays responsible for premature aging, immune dysfunction and some cancers. Although UVA rays are abundant in the sunlight that reaches Earth, they are thought to play less of a role in the development of cancer. UVB

rays, on the other hand, are responsible for the majority of the negative effects on the skin, partially because of the immediate and obvious inflammation and redness as a result of sunburn. Beyond what we see on the surface, the internal skin damage UVB exposure causes is particularly worrisome.

## Reactive oxygen species

UVB radiation is responsible for a series of events inside the epidermal skin cells, including an increase of the damaging free radical reactive oxygen species (ROS). Free radicals are compounds with unpaired electrons. This lack of electron balance creates highly reactive atoms and molecules. There are many types of free radicals, yet ROS have been widely studied because of their particularly damaging effects on the skin. Of the wide variety of environmental offenders, ultraviolet radiation is a primary contributor to the overproduction of ROS and oxidative stress in the skin. ROS include hydroxyl radicals, nitric oxide, peroxy nitrite, superoxide anions, peroxide, triplet oxygen and singlet oxygen.

ROS are widely known for their ability to cause damage to cellular proteins, lipids and DNA. The key to avoiding this oxidative stress and resulting damage is keeping the skin's radical and antioxidant levels in balance.

## Importance of antioxidants

Because ultraviolet radiation is known to increase the production of ROS and upset the skin's balance (homeostasis), the addition of topical antioxidants to any daily care regimen is especially important. Skin out of balance is more susceptible to the DNA damage and mutation that are the leading causes of skin cancers.

Sunscreen formulations should include antioxidants to help prevent the initial over-production of ROS and to support our natural defenses. If the sunscreen you recommend to your clients does not contain antioxidants, consider adding an antioxidant serum to their regimen.

## Beneficial phenolic antioxidants

Today, there are a multitude of antioxidant ingredients available in topical formulations. Although many show promise in helping reduce free radical damage and inflammation in the skin, the phenolic antioxidants listed have proven benefits for reducing ROS-induced photocarcinogenesis (sun-induced skin cancers) and photo-aging.

**Green tea:** The green tea *Camellia sinensis* plant is an abundant source of multiple potent polyphenol antioxidants. Epigallocatechin gallate (EGCG) is the most abundant green tea polyphenol and provides superior antioxidant, anti-

inflammatory and chemo-protective benefits. Clinical studies have shown that when EGCG is used prior to or immediately following ultraviolet exposure, it can reduce ultraviolet-induced cell mutations and immune suppression. EGCG has also been shown to inhibit lipid peroxidation and prevent the formation of ROS nitric oxide, hydroxyl radicals and singlet oxygen.

**Genistein:** This soybean-derived isoflavone is a powerful polyphenol that increases the skin's natural (endogenous) antioxidant defense system. Genistein's ability to prevent lipid peroxidation and hydrogen peroxide production and its interference with ultraviolet-induced cellular mutation and DNA damage make it an important addition to any daily care regimen. In addition, studies of genistein's activity showed strong prevention against the effects of both short- and long-term ultraviolet exposure, including redness, skin cancer and premature aging.

**Resveratrol:** Resveratrol is a potent polyphenolic antioxidant found in grapes, berries, peanuts and cocoa. Ongoing research on resveratrol's antioxidant action make its topical and internal benefits undeniable. Topical application of resveratrol prior to UVB exposure suppresses the production of hydrogen peroxide radicals and lipid peroxidation. Resveratrol also has shown the ability to inhibit the formation of malignancies. These attributes are key to resveratrol's ability to prevent the development of tumors in the skin.

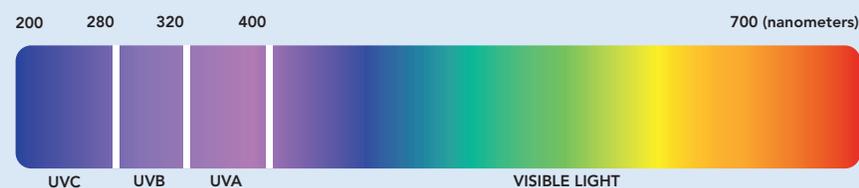
**Caffeine:** Caffeine is found in many botanical sources. Although it is not a polyphenol itself, it is believed that caffeine plays a key role in the behavior of several other polyphenol antioxidants, including green tea.

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## THE ULTRAVIOLET SPECTRUM

Ultraviolet rays are defined as UVA, UVB and UVC according to their wavelength:

- UVC: 200 to 280 nanometers
- UVB: 280 to 320 nanometers
- UVA: 320 to 400 nanometers



**Silybin marianum fruit extract:** Silymarin is a powerful flavonoid antioxidant that comes from the milk thistle plant. Its most active component is silybin. Recent studies have shown that silymarin inhibits lipid peroxidation and the formation of the damaging free radicals nitric oxide and hydrogen peroxide. It also has shown the ability to increase the skin's natural defense systems by stimulating the production

Studies comparing caffeinated and decaffeinated beverages showed a significant increase in the antioxidant activity of those containing caffeine. Caffeine is capable of reducing several ultraviolet-induced free radicals, including hydroxyl radicals, hydrogen peroxide, peroxy radicals and singlet oxygen. Research also suggests that topical application of caffeine can reduce ultraviolet-induced skin cancers by promoting cellular apoptosis in ultraviolet-exposed keratinocytes.

### Vitamins C and E and glutathione

An important symbiotic relationship in the skin is between the antioxidants vitamins C and E and glutathione. As ROS are produced in the skin due to ultraviolet exposure, they attack the lipid membrane of the cells in an attempt to reach DNA to cause mutations and cell damage. Ascorbic acid (vitamin C) is water soluble, so it is unable to impede the action of ROS in the lipid membrane. Tocopherol (vitamin E), however, is lipid soluble, so it is the perfect candidate to neutralize the free radicals before they can cause damage to the cellular lipids.

Unfortunately, as a result of this neutralization, tocopherol itself becomes a free radical. This is where ascorbic acid comes in. Vitamin C then reacts with the reduced tocopherol to turn it back into a stable molecule. This action of L-ascorbic acid makes it a co-antioxidant. For the best effect, formulations should contain lower percentages of tocopherol and higher percentages of vitamin C. This is because equal amounts of vitamin C will be used to neutralize the unstable vitamin E.

So, if you have five percent tocopherol, five percent vitamin C will be used to recycle that percentage back to a stable form. If your original topical formulation contained 15 percent L-ascorbic acid, a remaining 10 percent of the L-ascorbic acid will be available to work as a primary antioxidant to neutralize free radicals (as the other five percent of L-ascorbic acid

is committed to converting tocopherol back to a stable compound). This neutralization is achieved by L-ascorbic acid donating an electron to the radical to create a stable molecule.

The next piece of this puzzle is glutathione. Glutathione is a naturally occurring combination of the amino acids glutamine, cystine and glycine. Glutathione is found in the tissues of all plants and animals. It is a potent, endogenous antioxidant produced naturally by the body to prevent cellular damage. Products that contain topical glutathione fortify our natural antioxidant defense system to provide maximum free radical-quenching capabilities. Glutathione is also important because it prevents radicals from causing damage by recycling vitamins C and E, keeping them stable and active, thus making them better free radical fighters.

### Year-round protection

Although ultraviolet protection is paramount for most clients during the summer months, it is our job as clinicians to educate our patients about the need to continue these protective regimens throughout the year. Understanding the cascade of events that occurs in the skin following ultraviolet exposure highlights the importance of making sure your patients use strategic combinations of broad-spectrum sun protection and antioxidants daily, year-round. ■

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