UV-induced damage

UV rays are divided into three types based on wavelength. The shortest of these rays are UVC (200–280 nm), which the ozone layer currently prevents from reaching the Earth’s surface. Midrange UVB (280–320 nm) and long-wave UVA (320–400 nm) are the rays responsible for premature photoaging, immune suppression and several types of cancer. Although the quantity of UVA rays that reach the Earth’s surface is greater than UVB, they play a lesser role in the development of cancer. UVB rays are thought to be responsible for more of the adverse effects in the skin.

UV radiation is particularly damaging to the skin as it has been shown to not only increase levels of reactive oxygen species (ROS), but to deplete the skin’s own internal antioxidant levels as well. In order to adequately protect patients’ skin from this UV-induced free radical damage, and particularly the all-important extracellular matrix (ECM), topical antioxidant supplementation in addition to sunscreen use is becoming the standard of care.

Degradation of the matrix

The majority of a healthy dermis is the ECM, a complex framework of biomolecules designed to support and pro-
tect the dermal cells. The ECM is made up of structural proteins (collagen and elastin), adhesive proteins (laminins and fibronectin), glycosaminoglycans (GAG), and proteoglycans. These components experience normal breakdown due to intrinsic factors, but this degradation is accelerated and exacerbated by largely avoidable extrinsic factors—primarily UV exposure, and the resultant oxidative stress and matrix metalloproteinase (MMP) upregulation.10

MMP enzymes, such as collagenase, elastase, and hyaluronidase, are responsible for the natural recycling and destruction of the spent ECM’s components. MMP also play a role in the development of some types of tumors.11 Although a small quantity of MMPs are necessary for the maintenance of homeostasis within healthy skin, an over-production creates imbalance and unwanted dermal breakdown.

The expression of MMP is increased with as little as 0.1 minimal erythema dose (MED) (1/10 of the dose of UV exposure required to develop erythema).12 The degeneration of dermal collagen fiber bundles (DCFB) is more acute and severe in photodamaged skin, further demonstrating the connection between UV exposure and visible skin aging.13 The degradation of the ECM results in visible sagging and laxity, rhytides, epidermal and dermal atrophy, and enlarged pores.

PROVEN ANTIOXIDANT PROTECTION

Antioxidants are molecules that are able to slow or prevent the oxidation of other molecules. Antioxidants function in three ways: primary antioxidants, or electron donors; secondary antioxidants, which chelate metal ions; and co-antioxidants, which facilitate other antioxidants. Many offer multiple protective benefits.14 As mentioned, the human body does have its own endogenous antioxidant system designed to mitigate damage and maintain internal homeostasis between necessary breakdown and degradation that is damaging and accelerated. The use of topical cosmeceuticals containing antioxidants increases protection and limits damage.

Resveratrol has demonstrated the ability to prevent and limit the proliferation of cancer tumors in the skin.

Even the best sunscreen product cannot completely protect the skin from the onslaught of free radicals, increased MMP expression, matrix breakdown, visible aging, and, potentially, skin cancer. Boosting patients' regimens with topically applied antioxidants is a proven method of increasing protection and skin health.

Multiple antioxidant ingredients have demonstrated benefits for reducing the incidence of UV-induced aging and the development of some cancers due to oxidative stress resulting from free radicals.1,15 While there are thousands of topical antioxidants that are worthy of further study, the following are examples of several that have well-documented benefits for the skin:

Resveratrol is a natural constituent of certain colored berries, grapes, red wine and parts of the peanut plant. It is a potent polyphenolic compound that exhibits both primary and secondary antioxidant benefits in addition to inhibiting the upregulation of MMP. Topical application prior to UVB exposure has been shown to suppress the production of hydrogen peroxide radicals and lipid peroxidation.16,17 Resveratrol has also demonstrated the ability to prevent and limit the proliferation of cancer tumors in the skin.18

Silymarin is a powerful flavonoid antioxidant found in milk thistle whose most active component is the primary and secondary antioxidant silybin. Research indicates that silymarin inhibits lipid peroxidation and the production of a number of damaging radicals, while also increasing the amount of the skin’s natural glutathione.19,20 Protection against UV-induced immunosuppression, carcinogenesis and cellular degradation has also been attributed to topically applied silymarin.21,22,23

Green tea is the source of several potent antioxidants. Epigallocatechin gallate (EGCG) is found in abundance in camellia sinensis and is thought to provide green tea’s primary antioxidant, anti-inflammatory, and chemoprotective benefits. EGCG has been shown to inhibit lipid peroxidation and prevent the formation of nitric oxide, hydroxyl radicals and singlet oxygen.24 Research also indicates that topically applied EGCG reverses the suppression of the immune system due to UV exposure and speeds the degradation of skin cancer cells.25

L-ascorbic acid is the only true bioavailable form of vitamin C that delivers all of the vitamin’s topical benefits. Topically applied L-ascorbic acid serves as a primary, secondary, and co-antioxidant that effectively quenches ROS in the aqueous environment of the skin. It fights skin dam-
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Even the best sunscreen product cannot completely protect the skin from the onslaught of free radicals, increased MMP expression, matrix breakdown, visible aging, and, potentially, skin cancer. Boosting patients’ regimens with topically applied antioxidants is a proven method of increasing protection and skin health. Cosmeceuticals that contain antioxidants should be used daily in addition to broad spectrum sunscreen products that contain antioxidants within their formulations. Protecting patients’ skin from the known and avoidable extrinsic factors responsible for these negative outcomes should be the gold standard of care.

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