Study highlights need for better sunscreens

December 4 2013

A low level of daily exposure to a common component of sunlight can cause skin damage at the molecular level after just a few days, new University of Michigan Medical School research shows.

The findings highlight the need for better sunscreens to protect against these damaging rays, and prevent the process that can cause skin to look old, wrinkled and sagging prematurely.

In a new paper published online in *JAMA Dermatology*, the researchers show that damage starts after just two daily exposures to a low amount of ultraviolet A1, or UVA1, light – which makes up most of the UV light we are exposed to throughout the day, and tanning bed light too. Very few of the ingredients in sunscreen products effectively protect against UVA1. The damaging process kept going after further daily exposures.

By showing that repeated exposure to the type of UVA1 light that we typically experience on a sunny day causes these damaging processes in the skin, the researchers hope it will lead to the development of new protective ingredients in sunscreens, and more caution about routine sun exposure throughout the day.

The study was done by a team from the U-M Department of Dermatology's Photobiology and Aging Skin Research Program, and funded by the National Institutes of Health.

The researchers were able to measure the effects of UVA1 at the molecular level using advanced gene expression analysis of skin samples

from human volunteers.

The researchers shined a low level of pure UVA1 rays, as might be encountered in daily life, on small areas of 22 volunteers' buttocks. A day later, they measured changes in skin pigmentation. Then, they took tiny samples of skin, in order to detect which genes had been 'turned on' by the light exposure. They repeated this process three more times on each participant.

After just two exposures, UVA1 rays caused skin cells to make molecules that break down the protein called collagen, which makes skin firm, smooth, and youthful in appearance. The UVA1 also caused the skin to darken a little with each exposure, but this tan didn't protect against further production of the collagen-destroying molecule, called matrix metalloproteinase 1 or MMP1, when the skin was exposed to more doses of UVA1.

"Premature skin aging from UV exposure has gotten a lot of attention in the last 10 years, but most researchers have focused on UVB rays, which cause sunburn," says first author Frank Wang, M.D. "But there is very little UVB in sunlight, and most UVB exposure is at midday. During the rest of the day it's mostly UVA, with UVA1 being the majority. UVA1 is also the main component of tanning booth light. So, we wanted to look at whether it can predispose skin to premature aging by simulating repetitive daily exposure. And we found that it can. Furthermore, the mild tanning that occurs does not seem to protect against damage from additional exposures."

The study exposed the fair-skinned volunteers in a repeat manner to the amount of UVA1 they would receive in about two hours of strong sun exposure. Statistical analysis showed the pattern of MMP1 production increased progressively with repeated exposure in the majority of patients.

A medical dermatologist and assistant professor of dermatology, Wang notes that he often observes the collagen-damaging effects of repetitive sun or tanning booth exposure—with people in their 20s and 30s coming in for other conditions, but with clear signs of premature aging to their skin.

The U-M researchers, led by senior author and lab director Gary Fisher, Ph.D., the Harry Helfman Professor of Molecular Dermatology and Professor of Dermatology, have previously shown similar changes in skin cells from other types of UV light – including UVB.

However, in contrast with what the researchers had seen with their UVB experiments, the repeated UVA1 exposures didn't suppress the genes that make the molecules that become collagen.

The bottom line, they say, is that the new findings suggest a need for new sunscreen ingredients that can protect against UVA1 rays. Currently, only zinc oxide and avobenzone are approved by the U.S. Food and Drug Administration as sunscreen ingredients capable of blocking UVA1. Window glass, and most clothing, also don't necessarily filter out all UVA1.

Because UVA1 light from the sun reaches the surface of the earth whenever it's light out, the new research suggests that sunscreen with UVA1-blocking components could be useful throughout the day, not just during the peak sunburn hours of late morning to early afternoon, when UVB is most intense.

Though the current study didn't assess the impact of UVA1 on genetic changes that can lead to skin cancers, other forms of UV are firmly linked to most types of cancerous skin lesions.

Provided by University of Michigan Health System