Why EltaMD® sunscreens with Zinc are superior to Avobenzone products as post-procedural topical skin UV protectants
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INTRODUCTION
Swiss-American is the manufacturer of EltaMD® sunscreens formulated with high levels of the natural mineral Zinc Oxide, also referred to as Zinc or ZnO.

As post-procedure (PDT or laser) skin protectants, EltaMD® sunscreens with Zinc are superior to sunscreens with the chemical Avobenzone, specifically Avobenzone stabilized with Helioplex®. Three key clinical reasons substantiate EltaMD sunscreens as the better choice than products containing Avobenzone:

1. Superior sunscreen protection provided by any Zinc-based sunscreens over that protection provided by an Avobenzone-based product
2. Medical risks that may be associated with certain sunscreens with Avobenzone
3. Medical benefits of using sunscreens with sufficient levels of Zinc.

The context of this white paper is the application of sunscreen products as a post-procedural topical skin protectant. This application suggests that the skin of the user will be distressed or even abraded.

SUNSCREEN PROTECTION
There are two key facets of UV protection that cause Zinc to provide better protection than Avobenzone. The first is UV spectrum coverage and the second is photostability. These two characteristics of sunscreen ingredients speak to how much UV protection is provided and for how long.

The FDA monograph states that Avobenzone can only be used at a maximum concentration in any sunscreen at 3%. Conversely, Zinc is safe enough to use at a maximum concentration of 25%.

UV SPECTRUM COVERAGE
The chart below is a comparison of the UVA/UVB rays absorbed or reflected by these two ingredients. This chart is a measurement of UV protection as indicated by the space under each curve for Avobenzone at 3% (the blue curve), and Zinc (Zano® 10 Plus, the red curve) at 7.5%. Note that all areas under the curves represent the portion of UV rays that are screened with specific wavelengths indicated along the X-axis.

![Model Film Extinction Chart](image)

The area under the Zinc curve (top/red) is greater than the area under the Avobenzone curve (lower/blue), indicating Zinc provides better UV protection for all UVA/UVB wavelengths.

The data presented in this graph is from an evaluation after initial application and does not take into account the rapid erosion of effectiveness for Avobenzone.1

Conclusion: Zinc provides better overall UV protection than Avobenzone.
PHOTOSTABILITY

Photostability, the second key sunscreen criteria after actual UVA/UVB protection, is a measurement of how long a specific sunscreen will protect. This is a key component to sunscreen comparisons due to the fact that many UV protective ingredients absorb rather than reflect UV rays. As rays are absorbed by a UV protective ingredient, the protection provided by that ingredient is eroded. Physical UV protectors such as Zinc and Titanium do not substantially change their chemical composition when exposed to UV. Chemical UV protectors such as Avobenzone, Oxybenzone, Octocrylene, Octisalate and Homosalate perform by absorbing UV. As these ingredients absorb UV they decompose and UV protection eventually is gone.

Avobenzone is a chemical that is not inherently photostable. It requires the addition of other chemicals added to it to make it photostable. Without these additional chemicals Avobenzone erodes very rapidly as a UV protector.

The chart below shows a photostability erosion comparison of a 3% unstabilized Avobenzone concentration, versus a 7% Zinc concentration. The UV protection of both concentrations was initially measured, and then each was exposed to the same amount of UV light equal to 4 MEDs (5.7 J/cm² TUV per MED). The protection evident after exposure was then expressed as an index of the initial protection recorded.

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>UVA</th>
<th>UVB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc: 7% (Zano®)</td>
<td>92%</td>
<td>91%</td>
</tr>
<tr>
<td>Avobenzone: 3%</td>
<td>51%</td>
<td>75%</td>
</tr>
</tbody>
</table>

*One MED ( Minimal Erythemal Dose) is the amount UV light that elicits just perceptible redness 24 hours after UV exposure. Skin color change as the MED metric is an indication of the affect of UVB rays.

Note that the UVA protection provided by Avobenzone after UV exposure had eroded by almost half, whereas the protection of Zinc had only eroded 8%. Because MEDs are an expression of UVB protection, the more rapid erosion of protection from cancer causing rays (UVA) is largely undetectable, except when an evaluation such as this is performed.

**Conclusion: Without stabilization, Avobenzone would rapidly erode to a point where it provided no UV protection, especially for cancer causing UVA rays.**

As a result of this lack of stability, it is necessary for Avobenzone to be made stable with the addition of other chemicals. In some stability formulas the chemicals added can create certain medical risks.

MEDICAL RISKS OF AVOBENZONE

To achieve higher levels of UV protection, some sunscreen formulas containing Avobenzone (such as Neutrogena® Helioplex®), must add other UV protectors. Oxybenzone is a UV protectant ingredient used to bolster the UV protection of Avobenzone formulas. Studies show that Oxybenzone is one of the least safe UV protectors because it is absorbed into the skin and can prove to be irritating to users with certain sensitivity. Among studies drawing that conclusion are these:
• A 2008 study\(^2\) found Oxybenzone present in 96.8% of 2,517 urine samples collected as part of the 2003-2004 National Health and Nutrition Examination Survey. This indicates that for about all users of Avobenzone sunscreen with Oxybenzone, a certain percentage of Oxybenzone is absorbed into the body with daily application. All common sunscreens penetrated into the stratum corneum but only Oxybenzone is proved to present appreciable amounts in deeper tissue and the system.

• A 2001 German study\(^3\) found Oxybenzone has also been detected in human breast milk following topical application. Women that are pregnant or breastfeeding, in particular, should be cautious and avoid sunscreen products containing Oxybenzone.

• Initial research in both these studies\(^2\)-\(^3\) suggested that some form of toxicity might be present as a result of Oxybenzone absorption. While no such analysis has yet been performed, products in the European Union intended for sun and skin protection containing 0.5% or more Oxybenzone are required to be labeled, “Contains Oxybenzone.”

• Finally, while photoallergic reactions to UV protectors are generally rare, a 2001 UK study\(^4\) found Oxybenzone to have a much higher rate of reactions compared with other UV protectors.

Conclusion: Certain sunscreens containing both Avobenzone and Oxybenzone may present a high risk to users in that Oxybenzone can enter their systems and may irritate their skin, especially post-procedure abraded skin.

MEDICAL BENEFITS OF ZINC

When considering sunscreen formulations for post-procedure abraded skin, those with Zinc are the best option. Zinc not only provides significant UV protection for a prolonged period of time, it also offers medicinal benefits Zinc for wound healing. Whereas Oxybenzone has been known to cause skin irritation on people with intact skin, Zinc is proven as a highly effective wound healing agent.

Zinc naturally occurs in the body and plays a role in metalloenzyme activity, as it is used by the body to assist in the activity of more than 300 enzymes such as matrix metalloproteinases (MMPs). The ultimate effect of Zinc seems to be in the acceleration of re-epithelialization within a wound, yet most of the mechanisms are unknown. What has been clearly demonstrated, however, is that Zinc does have a positive impact on the wound.\(^5\)

Zinc has been found to promote epithelialization of full thickness skin wounds by the activation of Zinc-dependent MMPs, which facilitate keratinocyte migration. The study also demonstrated that Zinc augmented endogenous expression of insulin-like growth factor (IGF-1), which is fundamental in the production of granulation tissue.\(^6\)

The beneficial effects of Zinc in wound healing have been reported to explain the retarded wound repair response seen in Zinc-deficient patients along with the normalization of the wound healing mechanisms with Zinc therapy.\(^6\)

Conclusion: The ability of Zinc to help heal wounds while providing effective UV protection for post-treatment skin makes Zinc superior to sunscreens with Avobenzone or other chemical-based products.
SUMMARY
Comparing the effectiveness of Zinc versus Avobenzone as a primary ingredient in a post-procedure topical sunscreen product, results in three important conclusions:

1. Zinc provides better UV protection for post-procedure abraded or damaged skin, thus minimizing the risk harmful UV exposure.
2. UV protection from Zinc lasts significantly longer than unstabilized Avobenzone, and when Avobenzone is stabilized and combined with Oxybenzone, the probability of skin irritation is greatly increased.
3. Zinc has clinically proven wound healing properties, making Zinc-based sunscreens particularly suitable for use by post-procedure patients.

Summary Conclusion: When comparing Zinc-based sunscreens with Avobenzone with Oxybenzone products Zinc-based sunscreens are the clear choice as both a UV protectant and a wound healant for post-procedure skin.

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4. Photocllergic contact dermatitis is uncommon., Darvay A, White IR, Rycroft RJ, Jones AB, Hawk JL, McFadden JP., Department of Environmental Dermatology, St John's Institute of Dermatology, St Thomas' Hospital, Lambeth Palace Road, London SE1 7EH, UK. amritdarvay@doctors.org.uk

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