**The Efficiency of UVB Radiation Transmission Through Various Plastic Acrylics and Wraps**

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**Introduction**

- Vitamin D is essential for nutrient absorption to maintain bone health and is related to decreased risk of cancer and cardiovascular diseases.
- Vitamin D can be acquired through sun exposure (healthy, well, or covered) or supplementation through cutaneous production after solar or artificial UVB radiation exposure.
- In the skin, UVB radiation converts 7-dehydrocholesterol to previtamin D3, which then is converted to vitamin D3, also producing byproducts of lumisterol and tachysterol (Figure 2). The optimum wavelength for the LED device for vitamin D production is 250 nm, which was found to be the 2.4 times more efficient in converting to 7-Dehydrocholesterol (D3) or to previtamin D3 in human skin than the sun. The peak wavelength for the LED is 295 nm.

**Methods**

**Irradiation of Ampoules under UV Lamp at 10 MEDs with Acrylics and Saran Wraps**

1. The plastic wrap (Gladwep, Saran wrap, or Stretch-tite or plastic acrylic (Euonik or Evonik Industries B), 125, 140, or 240 microns) was placed even over a plastic frame containing three 7-DHC ampoules (0.5 mg in methanol) (Figure 3A and 3B). Three 7-DHC ampoules without any covering served as control.
2. All samples were irradiated 15.5 cm from the UV lamp (Sperti lamp) for 15 minutes (10 Minimal Erythema Dosage (MED)). A MED is the minimum amount of UV radiation required to produce 10 minutes of redness. A standard deviation. n=3.

**Irradiation of Ampoules with UV-emitting LED or UV Lamp**

- Evaluation of Plastic Wrap and Acrylics with Sperti UV Lamp: Stretch-tite plastic wrap and EUonik 60 micron acrylic were placed over the UV lamp for 10 minutes (25 cm away for 18 minutes).
- Evaluation of the Plastic Acrylic and Plastic Wraps with UV-emitting LED: Stretch-tite plastic wrap and EUonik 60 micron acrylic were placed over the UV lamp for 10 minutes (15 cm away for 18 minutes).

**Irradiation and Analysis of Skin Samples Exposed to UVLED**

- Surgically obtained (approved by BUMC institutional review board) type II human skin samples were taken postoperatively from patients with fat malabsorption syndromes such as Crohn’s disease, cystic fibrosis, inflammatory bowel disease, and gastric bypass surgery are at a high risk of vitamin D deficiency and would benefit from producing vitamin D3 in their skin to satisfy their needs rather than take supplementation. Therefore, these patients would benefit from either previtamin D production in their skin as well as a replaceable plastic wrap to switch after every use, so oils could be removed and covered with plastic acrylic (2A) and plastic wrap (2B).

**Results**

- Those with fat malabsorption syndromes such as Crohn’s disease, cystic fibrosis, inflammatory bowel disease, and gastric bypass surgery are at a high risk of vitamin D deficiency and would benefit from producing vitamin D3 in their skin to satisfy their needs rather than take supplementation. Therefore, these patients would benefit from either previtamin D production in their skin as well as a replaceable plastic wrap to switch after every use, so oils could be removed and covered with plastic acrylic (2A) and plastic wrap (2B).

**Discussion and Conclusion**

- In figure 8, the peaks detected by the HPLC show presence of previtamin D and its photoprodutcs, lumisterol and tachysterol, in both the control and when the 125 and 140 micron acrylic from Euonik industries were placed between the ampoule and the UV source. The peaks are known to be previtamin D and 7-DHC due to the UV spectra shown. Thus, the acrylics allow transmission of UVB radiation and facilitate conversion of 7-DHC to previtamin D.
- An evaluation of the thickness of acrylics from Euonik Industries and Euonik show no significant difference in the percent conversion of 7-DHC to previtamin D and its photoprodutcs in each of the acrylics. The acrylics decreased the conversion of 7-DHC by an average of 20%. This is in line with the report sent from the manufacturer about the transmission of UVB radiation in the acrylics.
- Due to the fact the 7-DHC conversion was unaffected by the thickness of the acrylics, it is likely the UVB radiation blocked by the plastic acrylic was reflected instead of absorbed. Further research is needed.
- In all types of plastic wrap (Gladwep, stretch-tite and saran wrap), there was no significant difference in 7-DHC conversion to previtamin D and its photoprodutcs. On average, the plastic wraps blocked 10% of the 7-DHC conversion to previtamin D. This could be due to UVB reflection or a contaminant in the plastic wraps.
- In plastic wraps sold in the US, polyethylene is the main component. It is a structure with only single bonds, so it should not absorb any UV radiation, as it has no conjugated double bonds. However, some of the UVB radiation was blocked, suggesting a contaminant or reflection of UVB radiation.

**References**


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