Novel Use of an Ultraviolet Emitting LED for Producing Vitamin D3 in Human Skin
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Introduction

Vitamin D deficiency continues to be a major issue globally. In addition, patients with fat malabsorption syndromes and patients after gastric bypass surgery often are unable to absorb vitamin D either from their diet or from supplements. There continues to be a need to find a safe alternative by harnessing the human skin’s natural ability to produce vitamin D after solar ultraviolet radiation (UV) exposure.

Currently, there are 2 commercially available light sources (mercury arc and fluorescent bulbs) capable of producing vitamin D in the skin. Both of these devices are somewhat cumbersome and generate a significant amount of heat. Dr. Moustakas’s laboratory recently developed an LED light that emits broad spectrum UV radiation, including the spectrum responsible for making Vitamin D in the skin.

Our project investigated the efficiency and effectiveness of this novel LED UV emitting radiation source in producing vitamin D in surgically obtained human skin samples from subjects of all skin types. Ultimately, commercialization of an easily portable LED UV source to produce vitamin D in the skin for people with fat malabsorption syndromes could provide an invaluable tool to combat vitamin D deficiency in this vulnerable population.

Methods

1. Irradiate human skin samples obtained from plastic surgical procedures with LED UV radiation for 10 and 20 minutes
2. One sample from skin type VI was also placed on the roof under direct sunlight at midday in July
3. Remove the epidermis from the skin sample
4. Extract the epidermis with 8% ethyl acetate in hexane
5. Measure the vitamin D content using High Performance Liquid Chromatography

Results

Four different skin types were irradiated with the UV LED for 10 minutes. Using the Fitzpatrick Scale of skin classification, they were classified as skin types II, IV, V, and VI. Each of the skin types exposed to LED UV radiation made vitamin D (Figure 2 and Figure 4). The control skin pieces (un-irradiated with UV LED) did not make any vitamin D. Skin types IV and V, when exposed for 10 and 20 minutes demonstrated a time dependent increase in the production of vitamin D (Figure 2). A sample of skin type VI was also placed in direct sunlight at midday in July for 1 hour and generated as much vitamin D as a skin sample under LED UV radiation for 10 minutes (Figure 2).

Conclusion

Preliminary data on the use of a UV LED to produce vitamin D in human epidermis is very promising. Our data shows that human skin exposed to the UV LED produces vitamin D and there was a time dependent increase in the production of vitamin D. Our data also suggest that 10 minutes under the UV LED is equivalent to 1 hour of sun exposure at noontime in July. These results indicate that it would be possible to create a wearable light source to combat vitamin D deficiency, especially in people with fat malabsorption syndromes.

References


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