25-Hydroxyvitamin-D3 serum modulation after use of sunbeds compliant with European Union standards: A randomized open observational controlled trial

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Background: Regular use of sunbed exposure has been reported to increase 25-hydroxyvitamin-D3 [25(OH)D] serum levels. However, the influence of sunbeds compliant with the recent European Union standard EN-60335-2-27 on 25(OH)D serum levels is unknown.

Objective: We investigated the impact of standard sunbed use compliant with the European Union standard on 25(OH)D serum modulation and well-being.

Methods: In a randomized controlled study, 25(OH)D serum levels were measured at enrollment, after 1 week, and after completion of the 12-week period of sunbed use with twice weekly exposure and compared with the control group without any sunbed exposure.

Results: In the sunbed intervention group (N = 31), a 27% increase of mean 25(OH)D levels was noted 1 week after starting sunbed use ($P < .01$). However, after 12 weeks, mean 25(OH)D levels had declined and were no longer different from baseline ($P = .06$). After 12 weeks, 25(OH)D levels did not differ between the intervention and control group ($P = .36$). Also the 5-item World Health Organization Well-Being Index score did not differ between the sunbed and control groups ($P = .19$).

Limitations: For ethical reasons recruitment was limited to persons actively seeking sunbed exposure.

Conclusions: Standard use of sunbeds compliant with the European Union standard induced a transient increase of 25(OH)D levels, whereas no change in well-being was observed. (J Am Acad Dermatol 2017;77:48-54.)

Key words: EN-60335-2-27; phototherapy; sunbed; ultraviolet A; ultraviolet B; vitamin D; 5-item World Health Organization Well-Being Index; 25-hydroxyvitamin-D3.

25-Hydroxyvitamin-D3 [25(OH)D] maintains calcium and phosphate homeostasis and is essential for normal bone mineralization and growth.[1] Besides the calciotropic functions, multiple studies reported that 25(OH)D also plays a role in cardiovascular disorders, certain cancers, infections, multiple sclerosis, diabetes mellitus, and inflammatory bowel disease, among other conditions.[2,3] The precursor of vitamin D3, 7-dehydrocholesterol, reacts with ultraviolet (UV) radiation inducing photochemical conversion into previtamin D3 in the epidermis, which is rapidly converted to 25(OH)D.[4,5] The optimum wavelengths for production of previtamin D3 are between 295 and

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300 nm[6] and UV phototherapy has been shown to increase serum 25(OH)D concentrations in several studies.[7-9] However, almost all of the studies were performed with UVB broadband; only 1 study by Rogers et al[10] investigated the vitamin-D plasma increase under psoralen plus UVA therapy. Although the action spectrum for the conversion of 7-dehydrocholesterol to vitamin D3 is thought to be within the UVB range (280-310 nm), the results of Rogers et al[10] suggested that the higher wavelengths of UVA (310-400 nm) may also have an effect, at least in the presence of psoralen. A more recent investigation found that narrowband UVB increases 25(OH)D values as early as 1 week after the start of phototherapy and consistently at week 12, whereas UVA1 resulted in a small but measurable decrease in 25(OH)D levels.[11]

CAPSULE SUMMARY

- Regular use of sunbed exposure has been reported to increase 25-hydroxyvitamin-D3 serum levels.
- Use of sunbeds compliant with the European Union standard EN-60335-2-27 induced only a transient increase in 25-hydroxyvitamin-D3 levels.
- The presumed beneficial effects of regular sunbed use on 25-hydroxyvitamin-D3 levels and overall well-being should be re-evaluated.

Several studies have also reported an increase of 25(OH)D serum levels after sunbed exposure.[5,12-16] Sunbeds typically emit UVA1 and UVA2 with small amounts of UVB. However, in these investigations the follow-up was limited to at most 10 weeks.[5,12-14] The recent European Union (EU) standard EN-60335-22-7 recommended that the total effective irradiance must not exceed 0.3 W/m^2, weighted according to the erythema action spectrum. It is therefore unclear to what extent the use of a sunbed consistent with these standards will influence serum levels of 25(OH)D. In this study, we assessed 25(OH)D serum levels after standard sunbed use to determine the impact given these newly introduced standards.

METHODS

Study population

The study was approved by the ethics committee of the Canton of Zurich (KEK no. 2013-0323). Volunteers were included if they met the following inclusion criteria: 18 years or older and written informed consent. Volunteers were not enrolled into the study if they fulfilled any of the following exclusion criteria: skin type I according to Fitzpatrick, sunbed use within the last 3 months, use of vitamin-D supplements, any medical condition that renders them unfit for sunbed use in the judgment of the investigator, and inability to provide oral and written consent to participate. Subjects were randomly allocated to sunbed use (n = 31) or control group without sunbed use (n = 23). The baseline values and characteristics of study participants are shown in Tables I and II. The study was registered in the public clinical trials database (ClinicalTrials.gov-identifier: NCT01976481).

Study design

The study was designed as a randomized controlled trial in volunteers from among individuals intending to initiate sunbed use. Sunbeds used in the study were compliant with the EU standard EN-60335-2-27. Serum 25(OH)D levels were measured in all participants at enrollment and after completion of the 12-week period. Serum measurements were repeated in the sunbed group 1 week after the start of sunbed exposure as well. All participants were asked to complete a questionnaire evaluating the 5-item World Health Organization Well-Being (WHO-5) Index at the beginning and at the end of the study. The primary end point was the change in serum 25(OH)D levels in subjects after 12 weeks of continued sunbed use in the 2 arms of the study. Of secondary interest were changes in well-being during the 12-week period.

Outcome measurement

Serum 25(OH)D levels were measured using the total vitamin-D assay run on the Cobas-8000 device (Roche Diagnostics International Ltd, Rotkreuz, Switzerland). The WHO-5 Index is a questionnaire assessing subjective psychological well-being and consists of 5 questions, which assess subjective well-being of the respondents.

Sunbed use

In the current study a Lightech lamp Vita D (GE Lighting, East Cleveland, OH) was used as a light source compliant with the EU standard EN-60335-22-7. The sunbed use was initiated at 0.5 minimal erythema dose and was increased to 0.75 and 1 minimal erythema dose in the following sessions. One minimal erythema dose was maintained as a dose for the remaining sessions. Two sessions per week were performed for a maximum of 12 weeks and for a maximum of 40 sessions per year. The control group received no sunbed exposure. The