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THE ASSOCIATION OF TANNING AND MELANOMA IN ADULTS: A LITERATURE REVIEW

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Abstract:

Objective: *In this paper we aim to present a clear discussion of the relationship between indoor tanning and melanoma risk, and to identify potential strategies for effective melanoma prevention by addressing indoor tanning device use.*

Methodology: *We reviewed relevant literature on the risks of indoor tanning, current indoor tanning legislation, and trends in indoor tanning and melanoma incidence.*

Results:

Our findings reaffirm the relationship between indoor tanning and melanoma risk and suggest a widespread public misunderstanding of the negative effects of indoor tanning.

Conclusions: *This review argues for an aggressive initiative to reduce indoor tanning, to design prevention efforts tailored towards specific high risk groups, and the need to better inform the public of the risks of indoor tanning.*

Keywords: *Melanoma, Tanning, Risk factors, Prevention, Adults.*

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INTRODUCTION:

In 2009, as a response to data highlighting the risks associated with indoor tanning, the World Health Organization International Agency for Research on Cancer (IARC) classified ultraviolet light emitted from tanning beds as carcinogenic and placed artificial sources of ultraviolet radiation alongside tobacco and asbestos in the highest category of carcinogen [1]. The Society of Behavioral Medicine issued a position statement calling for a ban on indoor tanning in minors in 2014, and the American Academies of Dermatology and Pediatrics also released recent reports in support of a total ban on indoor tanning in individuals under the age of 18 [2].

Despite these and other efforts to reduce indoor tanning, melanoma incidence is rising in the United States and worldwide, over and above the effects of screening [3,4]. It is the goal of this paper to explore current evidence supporting the relationship between indoor tanning and melanoma risk, and to promote novel efforts to reduce melanoma incidence by identifying and targeting the populations most at risk of negative consequences from tanning indoors.

METHODOLOGY:

Sample

We performed comprehensive search using biomedical databases; Medline, and Pubmed, for studies concerned with placenta previa published between 1975- 2019 in in English language. Keywords used in our search through the databases were as {Melanoma, Tanning, Risk factors, Prevention, Adults}. More relevant articles were recruited from references lists scanning of each included study.

Analysis

No software was used, the data were extracted based on specific form that contain (Title of the study, name of the author, Objective, Summary, Results, and Outcomes). Double revision of each author outcomes was applied to ensure the validity and minimize the errors.

RESULTS and DISCUSSION:

The health risks of UV radiation obtained from indoor tanning

A common misconception among indoor tanners is that artificial UVR produces a “safer” tan than outdoor sunlight [5]. This belief is contradicted by scientific evidence and must be addressed in order to effectively reduce the burden of indoor tanning on health outcomes worldwide. Exposure to UVR from indoor tanning devices has been shown to cause DNA damage in skin cells and is associated with an increased risk of developing melanoma, and squamous and basal cell carcinomas [6]. Indoor tanning has also been associated with accelerated skin aging, ocular melanoma, immune suppression, and skin burns [7]. Due to variation in the intensity and UV wavelength emitted by indoor tanning devices, consistent regulation of their use is paramount. Indoor tanning devices exert their effect through the emission of both UVA and UVB radiation. While UVB is associated with direct DNA damage through cyclobutane pyrimidine dimer formation and the production of DNA damaging photoproducts, UVA exposure is associated with indirect DNA damage through the production of reactive oxygen species [8]. Solar UVR reaching the earth's surface is composed of roughly 95% UVA and 5% UVB radiation [1]. UVB radiation induces burning of the skin at a much lower dose than UVA, which requires emissions 500 to 1000 times that of UVB to evoke a response [9]. Although UVB produces a delayed erythema (sunburn) or tan more efficiently than UVA, UVA alone is sufficient to cause a reaction [10]. Indoor tanning devices can emit UVR in amounts 10 to 15 times higher than the sun at its most direct exposure [11]. In the 1990s UVB-exclusive high intensity tanning devices were developed, as well as high pressure UVA-only devices. Lazovich et al. examined the individual effect of these devices on melanoma risk [12]. The authors found users of high intensity devices, high pressure devices, and traditional sunlamps to have an increased likelihood of developing melanoma compared to respondents who had never tanned indoors. Lazovich et al. could not identify one type of tanning equipment as more associated with melanoma than another, replicating the findings of previous research on risk according to indoor tanning device type [13].

To address the association between indoor tanning and melanoma incidence, Lazovich et al. examined cases of invasive cutaneous melanoma diagnosed in individuals between the ages of 25 and 59 in Minnesota from 2004 to 2007. The authors concluded that the use of UVB and UVA indoor tanning devices conferred an elevated risk of melanoma that increased with use by years, hours, and sessions. Risks were seen across all device types, and regardless of the age of at which the individual first tanned. The likelihood of melanoma having ever tanned indoors was 1.74 (95% CI 1.42, 2.14), while the adjusted odds ratio ranged from 2.5 to 3.0 in the category of greatest use (more than 50 h, more than 100 session, 10 or more years). When taking anatomic site of melanoma into account, by gender the dose response pattern remained significant for both men and women for truncal melanomas, among men with head and neck melanomas, and women with melanoma of the upper or lower limbs. It was also noted that melanoma cases were more likely to have been burned when indoor tanning and reported a greater number of painful sunburns than controls.

While Lazovich et al. adjusted for outdoor sun exposure, Vogel et al. assessed melanoma risk in the absence of sunburn from outdoor UVR. Vogel reported that melanoma patients who had never experienced sunburn were four times as likely to have tanned indoors than melanoma patients who had never tanned indoors, including those who reported zero lifetime sunburns (odds ratio, 3.87; P = 0.002). In patients with a history of sunburn, melanoma patients reported a greater number of years and sessions of indoor tanning, and having started tanning indoors at an earlier age than controls [14].

A 2005 meta-analysis reported an odds ratio of 1.25 (1.05–1.49) of having a melanoma if having ever used an indoor tanning bed [15]. The risk was reported to increase to 1.69 (1.32–2.18) if the first exposure was as a young adult. These results were replicated by the International Agency for Research on Cancer and supported by a 2005 meta-analysis finding a 75% increase in risk of melanoma when indoor tanning began during adolescence or early adulthood. Sunbed use in adolescence was also noted to confer an additional risk of melanoma development by Cust et al. 2011, who reported the risk of melanoma attributed to sunbed use before age 35 as 75% [16].

A review of 27 observational studies associating use of sunbeds with skin cancers (BCC, SCC, and cutaneous melanoma) across western Europe found a summary relative risk of 1.20 (1.08–1.34) [17]. When examining only cohort and population-based studies, the summary relative risk was found to be 1.25 (1.09 to 1.43). Dose–response calculations highlighted a 1.8% increase in melanoma risk for every additional indoor tanning session per year, and that use of sunbeds before age 35 allowed a summary relative risk of 1.59 (1.36–1.85). Overall the authors reported that from 27 observational studies published in the past 30 years, the risk of cutaneous melanoma increased by 20% in subjects who had tanned indoors at any time in their lives. Extending Lazovich's findings in Minnesota between 2004 and 2007, Boniol et al. found that in the same population from 2005 to 2011, most summary relative risks between tanning and melanoma increased.

A 2014 international systematic review and meta-analysis examining 14,956 melanoma cases and 233,106 controls reported an OR of 1.16 (95% CI 1.05–1.28) for melanoma in individuals that had tanned indoors compared with subjects that had not [18].The association was strongest in those who had tanned indoors for more than 10 sessions (OR 1.34, 95% CI 1.05–1.71). Importantly, the authors reported that their findings were not statistically different between data collected before and after the year 2000, suggesting that current indoor tanning devices are no safer than those used in prior decades. A recent review concluded that more than 10,000 melanoma cases each year across the United States, Europe, and Australia can be attributed to indoor tanning [20]. The population proportional attributable risk was found to be 2.6% to 9.4%.

Recent trends in the changing anatomic site of melanomas also support a relationship between melanoma risk and indoor tanning. Over the last 15 years there has been a significant increase in truncal melanomas in females, especially in geographic areas reporting a high prevalence of indoor tanning. Indoor tanning exposes users to intermittent UVR on typically unexposed anatomical sites such as the trunk, and indoor tanners would thus be expected to show such an increase in melanoma incidence in these areas. It is possible that the observed trend may be explained by changes in sun exposure behavior such as novel fashion trends, increased time spent outdoors, or by population changes in genetic susceptibility to UVR, however there is little current data to support such alternatives [21].

Indoor tanning and sun sensitivity

The cutaneous effects of UVR from outdoor sun exposure are influenced by an individual's genetic and phenotypic characteristics. Exposure to solar UVR is consistently shown to be a major risk factor for melanoma most significantly in fair skinned populations with high sun sensitivity [22]. The number of common nevi, a response to solar UVR exposure in sun sensitive individuals, has been repeatedly shown as the most powerful predictor of melanoma risk [23].

How artificial UVR from indoor tanning devices affects individuals according to skin type and sun sensitivity remains unclear. It has not been definitively shown whether skin types with reduced sensitivity to outdoor sunlight benefit from a similar reduced sensitivity to the adverse effects of artificial UVR. This area of exploration is especially significant as individuals of low to moderate sun sensitivity are more likely to tan indoors and tan indoors with greater frequency than individuals with higher sensitivity to solar UVR [24]. Individuals with low to moderate sun sensitivity therefore represent an important population for anti-indoor tanning prevention efforts. Determining whether adverse events reported in relation to indoor tanning, such as skin erythema and the development of melanomas, disproportionately affect the minority of individuals with increased sun sensitivity who tan indoors, as opposed to uniformly affecting individuals who tan indoors regardless of sun sensitivity, also warrants further investigation.

The Fitzpatrick skin type classification system has been widely used to define an individual's response to UVR. Fitzpatrick skin types range from I to VI according to genetic disposition (factors such as eye and hair color) and reaction to sun exposure (propensity to tan or burn). Other systems to define sun sensitivity include measures of self-reported ability to achieve a tan in the sun, self-reported susceptibility to burn outdoors, objective dermal response to direct skin photo testing, assessment of skin pigmentation via reflectance wavelength measurement, and determination of UVR-B dose required to produce visible skin redness (termed minimal erythema dose (MED) [25].

Because a variety of methods have been used to classify skin type, generalization of results is difficult. Further, data exist to suggest that individuals may have limited accuracy in self-assessment of sun sensitivity. Harrison and Buttner examined the accuracy of self-assessment of skin color and level of protection from solar UVR by measuring the wavelength of light reflected from upper extremity skin sites [26]. They found that Caucasians are likely to overestimate skin pigmentation and level of protection from the sun. The authors argue that skin cancer prevention campaigns targeted towards individuals according to sun sensitivity are likely to fail due to poor individual self-perception of skin type. Taken together, investigation of a consistent and reliable measure of skin sensitivity, represents an important step in the effort to reduce melanoma incidence.

Populations at increased risk of indoor tanning

The most frequent indoor tanners in the United States are Caucasian females between the ages of 16 and 29 [27]. Epidemiological studies have associated increased indoor tanning with factors such as socioeconomic status, education, geographic location, and outdoor sun exposure [28]. While these factors may inform prevention efforts, the relationships determining these trends are complex and variable across populations. Appearance concerns are among the most consistent motivators of indoor tanning and represent an important interventional target [29]. In a study of United States adolescents aged 12–18 years old, girls were more likely than boys to report use of indoor tanning facilities, that it was worth getting burnt to get a good tan, and that tanned skin was preferred over pale skin [30].The concerning importance of appearing tan in this age group indicates the need for strong anti-indoor tanning interventions directed specifically towards a young population. In men, indoor tanning has been associated with appearance motivated behaviors, anxiety disorders, and unregulated steroid use [31].Interventions directed towards individuals at risk for these behaviors should also be considered.

Recently it has been suggested that excessive indoor tanning may lead to physiological addiction in certain individuals. Such an effect may help explain individuals who continue to tan indoors despite a diagnosis of melanoma. Additional studies report indoor tanners meeting DSM-IV-TR criteria for substance abuse and dependence with regard to their indoor tanning behaviors [32]. Exploring the neurobiological factors behind indoor tanning, for example the possible involvement of endogenous opioids, is a relevant avenue for exploration and prevention. In a study examining motivations behind continued indoor tanning despite awareness of risks, the authors cited reasons for indoor tanning beyond cosmetic concerns, specifically enjoyment of the tanning experience, an effect they termed 'mood enhancement' [33]. Screening individuals at risk for developing a psychological addiction to indoor tanning, and ensuring the proper resources are available to address such a condition, are important areas of anti indoor tanning intervention.

Proximity to indoor tanning salons has also been shown to correlate with increased indoor tanning in certain groups. Mayer et al. found that living within 2 miles of an indoor tanning facility was associated with a greater likelihood of indoor tanning in adolescents [34]. Across the United States, indoor tanning facilities are increasing in number [35].The rise in tanning salon prevalence presents a challenge in reducing indoor tanning behaviors. Limiting the density of indoor tanning facilities near residential areas, although difficult, is an important step towards reducing indoor tanning use.

Many states require parental permission for minors to tan indoors, although the effectiveness of this restriction may be limited by parental tanning behaviors and beliefs. Having a parent's permission to tan indoors strongly predicts increased indoor tanning among adolescents [36]. Bandi et al. examined the prevalence of indoor tanning, sunburn, and sun protection strategies in parents of adolescents between

1998 and 2004 [37]. Parental use of indoor tanning facilities increased between 1998 and 2004, and was most prevalent among parents aged 27 to 45. 50% of parents tanning indoors in the past year reported having tanned over 10 times, and 61% indicated that they had been burned as a result. Activities of parents and children have been shown to correlate positively, and therefore increased indoor tanning among parents presents an increased risk of indoor tanning to their children [37]. While intervention strategies should be targeted directly towards at risk children and adolescents, efforts directed towards parents should be prioritized as well.

CONCLUSIONS:

Although sufficient evidence associates indoor tanning with an increased risk of melanoma and non-melanoma skin cancers, there is also evidence to suggest that indoor tanning remains a widespread public health issue. These combined observations predict that without intervention, melanoma and other UV-related diseases will become more common in the near future and require a substantial prevention effort.

While many states have implemented bans on tanning bed use among children aged 18 or younger, this represents only a limited prevention effort, both geographically and by age group. While children are perhaps at the greatest risk of disease related to tanning bed exposure, young adults (over 18) are also at substantially increased risk of melanoma due to tanning bed use. There are few (if any) preventive interventions targeted at tanning bed use in young adults or in older adults, despite fairly substantial evidence of risks across all age groups.

Melanoma incidence is increasing worldwide, over and above the impact of screening. Without strongly enforced efforts to reduce indoor tanning in the most at-risk individuals, the effects of increased tanning bed use will contribute to a further increase in the burden of disease in the near future.

DISCLOSURE:

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